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ENGINEERING

American Gas Journal

THE MAGAZINE OF GAS DISTRIBUTION

OCTOBER 1960

SWIM IN HOT WATER!
APPLIANCE CENTER SPURS COOPERATION
GAS LIT AIRPORT
KING-SIZE MAIN IS KING-SIZE PROJECT
GAS COFFEE MAKER
CAVERN STORAGE OF LIQUEFIED METHANE?

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Success Story . . .

One year ago this month, a group of gas men from Texas journeyed to the A.G.A. annual convention in Chicago with a gleam in their eyes and a dream in their brief cases . . . and busily set out to convert an idea into reality. The result of their endeavors is the amazing *Gas Appliance Center* in the Dallas Trade Mart . . . a unified gas industry exhibit on a year 'round basis that has brought a new concept to gas industry appliance promotion and intra-industry cooperation.

In the far-flung, important southwestern marketing area, the *Gas Appliance Center* has made a big hit. Dealers, distributors, builders, architects, utilities, and manufacturers like it and use it. It has changed "cooperation" from a mere word to a real undertaking by all concerned. It has brought a new awareness of the stature and modernity of the gas industry to thousands and thousands of dealers and builders in the southwestern area . . . people important to the gas industry's growth. And the Center has achieved national fame, too.

What it is, what it's doing, where it's going . . . told on page 42 of this issue.

Coming Attraction . . .

AGJ consulting editor Joseph Kornfeld is currently traveling Western Europe, examining its gas industry, for a series of first-hand reports about gas engineering developments in an area that primarily has had a coal-based economy. Gas industry executives and operating personnel in the United Kingdom, the Benelux countries, West Germany, France, and Italy are being interviewed by Kornfeld to obtain up-to-date information on the status of gas — natural and manufactured — and its impact on the Western European economy.

New processes, such as the Lurgi high-pressure (250 psig delivery pressure) coal gasification plants, will be evaluated for their impact on the coal-based economy. Lurgi plants, for example, can yield 700 Btu gas from coal containing up to 25% ash and 16% moisture; such plants are now operating in Scotland, Germany, Czechoslovakia, and other countries.

Kornfeld's reports will cover other important areas . . . the effect of proposed nuclear reactors in competition with an oversupply of coal in Belgium and other countries . . . the present pattern of energy fuel sources in each country . . . the impact of the liquefied methane tanker system on the coal market . . . feasibility of the plan to import cheap natural gas from the French Sahara by pipelines under the Mediterranean . . . engineering developments that will prove useful in the U. S. gas distribution industry.

American Gas Journal

ONLY MAGAZINE EDITED EXCLUSIVELY FOR THE GAS DISTRIBUTION INDUSTRY

Volume 187 October 1960 Number 11

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Member Audit Bureau of Circulation and Associated Business Publications. Subscription Rates: U. S. and Canada $3.00 per year; $5.00 two years; $6.00 three years. South America and Foreign $5.00 per year. Single copies, $1.00 except August 15 Handbook issue not sold separately. Payments from outside U. S. A. may be made by international money order, New York exchange, check on U. S. bank, UNESCO coupons, or write for name of nearest representative who can handle your order in currency of your country. Send subscription correspondence and change of address to American Gas Journal, P. O. Box 1589, Dallas 21, Texas. Subscribers should notify publisher promptly of any change of address, giving old as well as new address including city postal delivery zone, if any. If possible, enclose address label from recent issue of magazine. Allow one month for change to become effective.

Printed in U.S.A.

M C F

NEWS HILITES OF THE INDUSTRY

Can big interstate gas pipeline companies raid franchised distribution companies of their industrial customers? What happens in Toledo, Ohio, may set a new trend for the industry. Toledo is served by Ohio Fuel Gas Company, a subsidiary of Columbia Gas System. OFG holds an exclusive (at present) franchise to furnish gas service in that city. Panhandle Eastern Pipe Line Company has petitioned Toledo's city council for a "limited franchise" to serve "new industrial customers." Legality of "limited franchises" is seriously questioned by that city. Panhandle claims it could sell gas to industry at lower rates than Ohio Fuel . . . and that it could do, not being subject to the 3% excise tax that OFG must pass on to its customers, and not having to serve any industrial customers, and by being able to sell large volumes to single customers. Ohio Fuel, refuting Panhandle's claims, estimates that the industrial gas service it supplies provides a "subsidy" of about $400,000 annually to residential service . . . and doubts that Toledo residential customers would want to pay that much additional cost. Toledo currently is resisting a rate increase asked by OFG to meet higher wholesale gas costs.

Pipeline companies can't pick and choose customers, says FPC examiner Francis L. Hall, especially because it finds some customers more profitable. In a decision involving Mississippi River Fuel Corporation, examiner Hall said the company must provide adequate service to its utility customers even if it means curtailment of service to MRF's industrial customers. The pipeline, noted the examiner, regards some of its industrial customers as "firm customers" even though each of its contracts with them provides for interrupting service. MRF pleaded that the "grandfather clause" of the Natural Gas Act gave it the right to serve its industrial customers without FPC regulation. Rejecting this contention, examiner Hall said that "grandfather certificates" authorized continuation of existing service after certificate provisions of the Natural Gas Act became effective on February 7, 1942. But, he stated, MRF's position ignored the fact that Congress, in enacting the Act, embarked on a program of regulation through FPC control of its (MRF's) operations. The examiner said MRF was really seeking permission to avoid its responsibilities to its industrial customers. He also criticized the transmission company's lag in expanding its facilities to provide more salable capacity.

California's gas supply . . . when is enough enough? Transwestern Pipeline Company began operations in September, supply up to 300,000,000 cu ft daily to Southern Counties and Southern California Gas Companies (subsidiaries of Pacific Lighting Corporation), and received a warm reception at a chamber of commerce luncheon. At the same time, Pacific Lighting officials gave an even warmer reception . . . in fact, a heated pledge of battle . . . to a proposal by Tennessee Gas Transmission Company and Southern California Edison Company to build a 1200-mile, $165,000,000 gas pipeline from South Texas through Mexico to Lower California to supply gas for the electric utility's generating plants. At stake is a contract (expiring July 1, 1962) whereby Pacific Lighting supplies Edison with gas. If the TGT-Edison-Mexican government deal goes through, Edison would not renew the contract. Such a move, says Pacific Lighting, would destroy the balance of operations of its two gas distribution companies in southern California. The Mexican line project would also have an adverse effect on the proposed Rock Springs line that would move gas to the area through lines of Colorado Interstate Gas Company and El Paso Natural Gas Company. That line could ultimately deliver more than 1-billion cu ft daily—enough to meet needs in southern California "for many years to come."

AMERICAN GAS JOURNAL, October 1960, Vol. 187, No. 11. Published monthly except August, then semi-monthly by The Petroleum Engineer Publishing Company, P. O. Box 1589, Dallas, Texas. Second class mail privileges authorized at Dallas, Texas. Executive and Editorial Offices at 800 Davis Building, P. O. Box 1589, Dallas 21, Texas.

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"Our experience with underwater installations caused us to select Cast Iron Pipe . . . AMERICAN Molox Ball Joint pipe," says one distribution engineer for an outstanding West Coast gas utility. The above view shows workmen assembling 10" AMERICAN Molox Ball Joint pipe on board the construction barge, part of a 3,500-foot underwater gas supply line. The 96-foot sections were lowered with the aid of a strongback for assembly beneath the surface.

Specify rugged AMERICAN Molox Ball Joint pipe for river crossings and other difficult underwater installations. Molox pipe affords maximum installation economies because it is easily adapted to several installation methods: It can be floated or pulled across streams, or can be installed directly on the bottom from a barge. Once laid, it remains bottle-tight at any angle. The joint is designed for deflections up to 15°.

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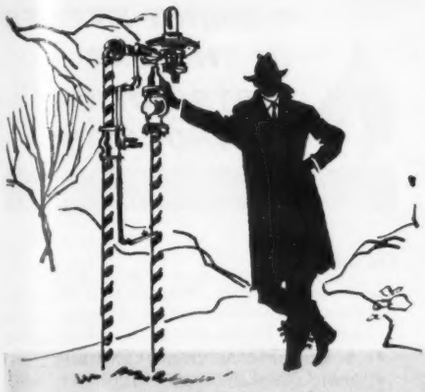

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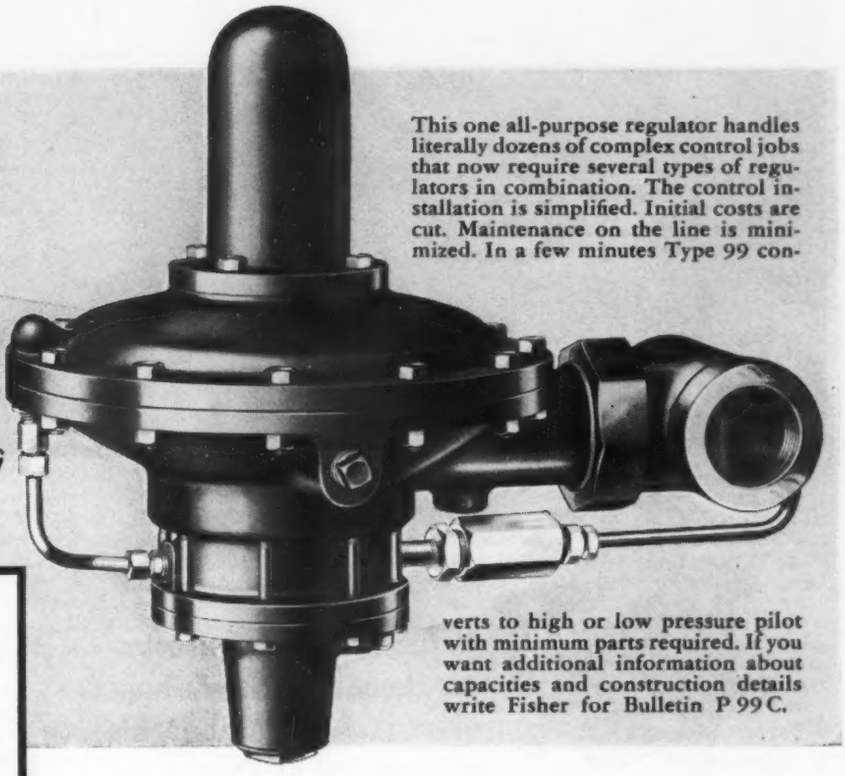
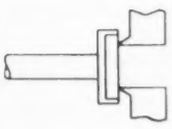
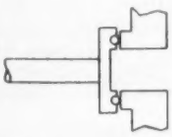


This one all-purpose regulator handles literally dozens of complex control jobs that now require several types of regulators in combination. The control installation is simplified. Initial costs are cut. Maintenance on the line is minimized. In a few minutes Type 99 converts to high or low pressure pilot with minimum parts required. If you want additional information about capacities and construction details write Fisher for Bulletin P 99C.

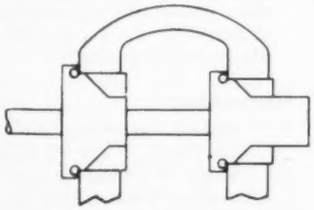
ORIFICE SIZES— INNER VALVE STYLES



⅛" Composition Disc Single Port. Max. Inlet 250 psi. 1⅛" Composition Disc Single Port. Max. Inlet 150 psi.



⅞" "O" Ring Single Port. Max. Differential 250 psi. 1⅛" "O" Ring Single Port. Max. Differential 250 psi. (with heavy main spring) 2" "O" Ring Single Port. Max. Differential 40 psi.



2" "O" Ring Double Port. Max. Differential 100 psi.

1. **The factory pre-set spring provides powerful lock-off action.**
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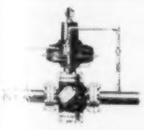
5. **Composition valve disc assures tight shutoff on zero flow and excellent regulation from low flow to maximum capacity.**



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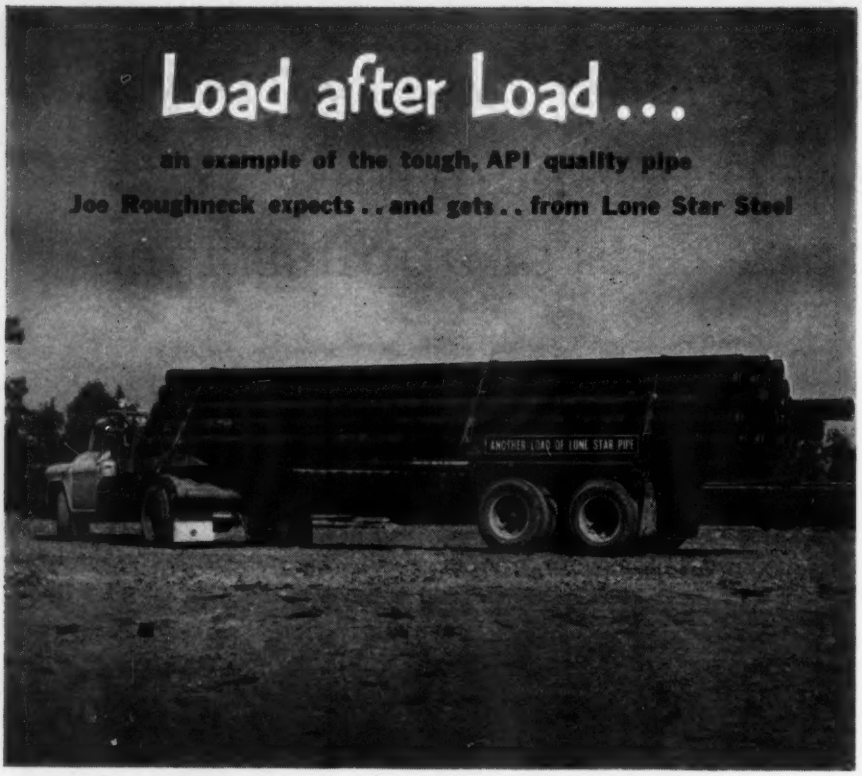

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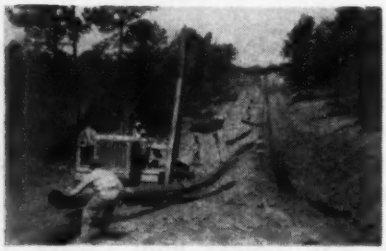

Crossing rivers, bending over hills and rugged terrain is routine for Lone Star line pipe.

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COMING EVENTS IN THE GAS DISTRIBUTION INDUSTRY

October

3- 4 Independent Natural Gas Association of America, annual meeting, Fontainebleau Hotel, Miami Beach, Florida.

4- 5 Gas Measurement Institute, National Guard Armory, Liberal, Kansas.

5- 7 Wisconsin Utilities Association, annual gas operating and sales convention, Schroeder Hotel, Milwaukee, Wisconsin.

6- 7 NACE western regional conference, Sheraton-Palace Hotel, San Francisco, California.

6- 8 NACE, southeast region conference, Dinkler-Plaza Hotel, Atlanta, Georgia.

10-12 A.G.A. annual convention, Atlantic City, New Jersey.

11-14 NACE, northeast region conference, Pritchard Hotel, Huntington, West Virginia.

17-21 National Safety Council, annual meeting, Chicago, Illinois.

19 NEGA street dept. supervisor's group, Hotel Bancroft, Worcester, Massachusetts.

19-20 NACE north central region conference, Schroeder Hotel, Milwaukee, Wisconsin.

21 NEGA commercial and industrial groups, Colonial Inn, Lynnfield, Massachusetts.

24-25 Independent Petroleum Association of America, annual meeting, Statler Hilton Hotel, Dallas, Texas.

24-25 ASME fuels conference with American Institute of Mining, Metallurgical and Petroleum Engineers, Daniel Boone Hotel, Charleston, West Virginia.

25-26 NEGA safety course, Parker House, Boston, Massachusetts.

25-28 NACE, south central regional conference, Mayo Hotel, Tulsa, Oklahoma.

26-27 1960 Computer Applications Symposium sponsored by Armour Research Foundation of Illinois Institute of Technology, Morrison Hotel, Chicago, Illinois.

27-28 "Engineering Application of Magnetodynamics," Engineering Institutes. Sponsored by the University of Wisconsin, University Extension Division and the College of Engineering. 3030 Stadium, The University of Wisconsin, Madison, Wisconsin.

November

1 NEGA operating division, Statler Hilton Hotel, Hartford, Connecticut.

3 Metal Treating Symposium, New Englander Motor Hotel, Westport, Connecticut. Sponsored by A.G.A. and The Bridgeport Gas Company.

14-16 American Petroleum Institute, annual meeting, Chicago, Illinois.

18-22 Air Conditioning and Refrigeration Institute annual meeting, Hollywood Beach, Florida.

27-Dec. 2. ASME winter annual meeting, Statler Hilton Hotel, New York City.

December

5- 9 A.G.A. Gas Air Conditioning Sales School, Columbus, Ohio.

MEN AT WORK

IN THE GAS DISTRIBUTION INDUSTRY

Recent Appointments

J. O. MacKay, chief mechanical construction engineer in charge of the newly-created mechanical construction department of Saskatchewan Power Corp. He was formerly project foreman in mechanical construction at Saskatoon.

Alfred S. Erwin, sales representative for American Meter Co. He will headquarter in Philadelphia.

Lewis I. Terry, laboratory manager of Dearborn Chemical Co. He will have complete charge of laboratory business and personnel administration and will also coordinate research and development projects. Terry was formerly director of analytical services for the company.

John N. Rolston, business development representative for consulting and design engineering services of Commonwealth Associates, Inc. He will headquarter in Jackson, Michigan. He was formerly vice president in charge of the Chicago office of United Engineers and Constructors, Inc.

Ted G. Breitag, manager of manufacturing engineering at the headquarters plant of Detroit Controls Division. He has been a management consultant since January 1958, and was formerly plant manager with Schieber Manufacturing Co.

Charles W. Niederauer, northwestern regional manager for the management consulting division of Ebasco Services, Inc. He will headquarter in Portland, Oregon; he succeeds **William F. Rooney,** who recently became director of business development for the division in New York.

Morton H. Cohen, field engineer in the Washington, D. C., sales district office of Electro-Mechanical Research, Inc.

Claude W. Brown, sales and technical service representative for Oklahoma and Kansas for Grove Valve and Regulator Co. He will headquarter in Oklahoma City.

Robert J. Cook, supervisor of pipeline sales for Union Switch & Signal, Division of Westinghouse Air Brake Co. He was formerly area representative for the company's midwestern area. **Daniel N. Rowswell, Jr.,** formerly project engineer for Koppers Co., has assumed the duties of sales engineer for the division.

Gustav A. Hoffman, vice president, sales for Walworth Company. He is returning to the company he served for 27 years before leaving in the spring of 1959. Previously he had held the position of assistant vice president in charge of metropolitan division sales with Walworth.

Mel Maddox, manager of the newly-formed pipeline coatings and materials division of Allied Materials Corp. The newly-formed division will produce both asphalt and coal tar pipeline enamels.

Chester R. Attwood, sales representative for Arkla Air Conditioning Corp. in the Chicago and surrounding areas succeeding Allen G. Barry, who resigned. Attwood served in various capacities with Servel, Inc., predecessor of Arkla, and more recently with Mathes Corp. in Fort Worth, Texas

Henry A. Porterfield, manager-advertising and sales promotion for Chapman Valve Co. of Indian Orchard, Massachusetts. He was formerly advertising manager and district sales manager for Ohio Injector Co.

Recent Promotions

O. M. Heartsill, general commercial engineer of Oklahoma Natural Gas Co., to manager of the Midwest City area.

Donald S. Deeter, central distribution district garage superintendent for Ohio Fuel Gas Co., to assistant superintendent of motor transport for Ohio Fuel. **Preston Gibson,** former Barnesville manager, succeeds Deeter as garage superintendent.

George E. Doty, formerly vice president-sales, to vice president and general sales manager of Grove Valve and Regulator Co. **B. J. Hancock,** formerly eastern regional sales manager, succeeds Doty as vice president-sales.

● **Lewis W. Imm,** pioneer in the computer field, has resigned as president of Librascope Division General Precision Inc., to enter a "new dynamic frontier of technology." **William E. Bratton,** presently executive vice president, will assume Imm's position.

● **Stanley B. Lord** has been named senior inspector and **Stanley L. Clewett** has been made field engineer in the construction and inspection section of Pittsburgh Chemical Co. **Salvatore A. Amelio** has joined the company as an engineer in the project section.

● **John Schlemmer** and **Harold Kreegel** have been named district sales managers for air conditioning, heat pump, and furnace products of Perfection Division, Hupp Corp. **James C. Pope** has been appointed district sales manager for wall furnace and space heater products in the Southeast. Schlemmer's territory covers northern California, Washington, and Oregon; Kreegel will head company's sales organization in Texas and Louisiana.

● **B. D. Wiesman** has been appointed sales promotion manager RCA Whirlpool refrigerators and freezers, a post made vacant by the recent promotion of **Quentin B. Garman** to national advertising manager.

● **Harold H. Heidrick** of Belmont, California, has been named public utilities consulting engineer for Wilsey, Ham & Blair, engineering and planning firm headquartered in Millbrae.

● **James W. Tyson II** of Concord, Massachusetts, and **James S. Eastham** of Andover, Massachusetts, have been elected directors of Boston Gas Co. Tyson is senior vice president of Eastern Gas and Fuel Associates; Eastham is vice president, secretary, and general counsel of Eastern Gas and Fuel Associates.

● Anchorage Natural Gas Corp. has elected **Dale Teel,** executive vice president and general manager of the company, and **Larry Landry,** Anchorage businessman and president of the Chamber of Commerce, to the board of directors. **Horace B. Webb,** Houston, has resigned; Anchorage people now hold 8 of the 12 positions on the board.

● **Robert A. Mittelstaedt** has been named superintendent of gas control for The East Ohio Gas Company to succeed William J. Giblin who retired September 1. Mittelstaedt will be responsible for flow of gas through more than 11,000 miles of pipe to 808,000 East Ohio customers.

R. A. Mittelstaedt

E. O. Hilbush

● **Edward O. Hilbush, Jr.,** development engineer with E. I. du Pont de Nemours and Co., has assumed the duties of president of West Chester Chemical Co. He has been a director of West Chester for eight years.

● **James A. Elkins, Jr.,** of Houston, Texas, and **J. Finley McRae** of Mobile, Alabama, have been elected to the board of directors of United Gas Corp. Elkins is president of City National and First National Bank of Houston. McRae is president of The Merchants National Bank of Mobile.

● Two operating executives—**John H. Shiner** and **Harold A. Wallace,** vice presidents of marketing and manufacturing respectively, have been elected to the board of directors of Massey-Ferguson.

● **Tom P. Walker,** former chairman of the board of Transcontinental Gas Pipe Line Corp., has been elected to the board of directors of Burgess-Manning Co. He continues as a member of the Transco board also.

● **Lester B. Inglis, Jr.,** formerly with The Columbia Gas System's United Fuel Gas Co., has been named assistant secretary of the American Gas Association's Operating Section. He succeeds **Fredric Moshier,** who has entered private business.

● **H. S. Hinrichs,** assistant secretary and assistant treasurer and director of community service for Kansas Power and Light Co. retires September 1 after 32 years of service.

● Manufacturers Light and Heat Co., subsidiary of Columbia Gas System, has elected **John P. Roche,** president of Hepenstall Co., a director of the Company.

● **John Van Dyke,** electrical design engineer for Columbia Gulf Transmission Corp., is being transferred to the newly-created post of automation engineer of Columbia Gas Service Corp. Van Dyke will coordinate development of automatic operation of compressor stations, metering stations, regulating stations and other facilities throughout the service area of Columbia Gas System.

● Standard Pipeprotection, Inc. has appointed **G. W. (Wally) Prager** as sales representative in the Colorado, Wyoming, Montana, Utah and Idaho area. Previously he was associated with E. W. Robinson Supply Co. of Houston.

Good Everywhere

CLEVELAND
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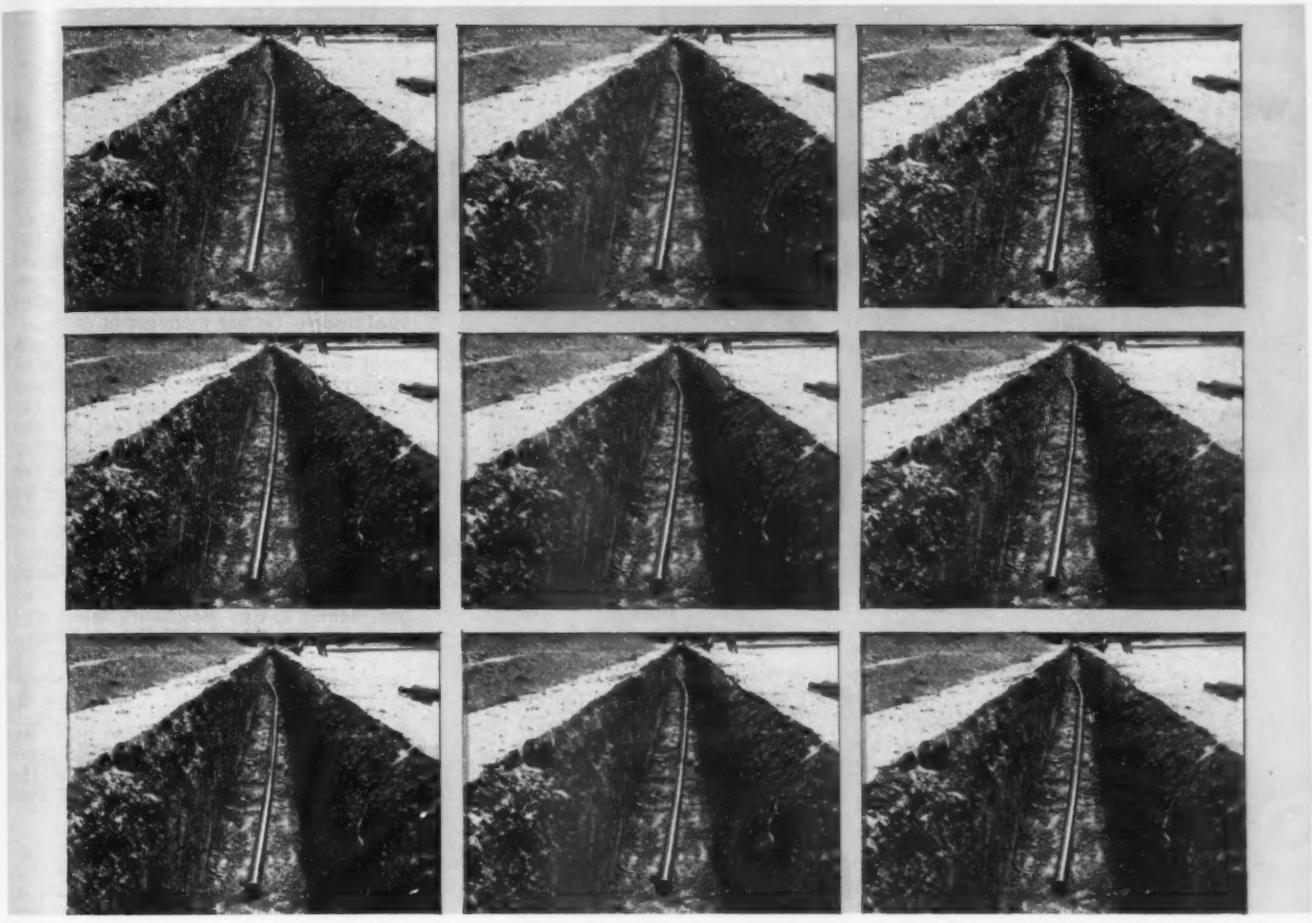
Naugatuck KRALASTIC

The Original ABS Resin



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THEY'RE SOLD ON ABS PIPE

Palo Alto, California, has just installed another KRALASTIC® pipeline, bringing the total of ABS pipe in use in that city to over 100,000 feet. The latest line, 2190 feet long, will carry natural gas.

Long service life with freedom from leaks and maintenance is the main reason for again choosing KRALASTIC for an important job. Soil in the area is highly corrosive, and metal pipe soon corroded and failed. Since KRALASTIC can't corrode, this problem no longer exists. KRALASTIC also has excellent dimensional stability and high impact resistance.

Ease of installation has been another decisive factor in the city's continuing use of KRALASTIC pipe. No expensive and cumbersome welds are necessary, no heavy equipment is required to install tough, lightweight KRALASTIC pipe. What's more, using KRALASTIC proved about ⅓ less costly than metal pipe.

Further proof of KRALASTIC pipe's reliability is the more than 14,000 miles of it now in use. For further information on how KRALASTIC can help you, see your Naugatuck representative or write:

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Naugatuck Chemical Division

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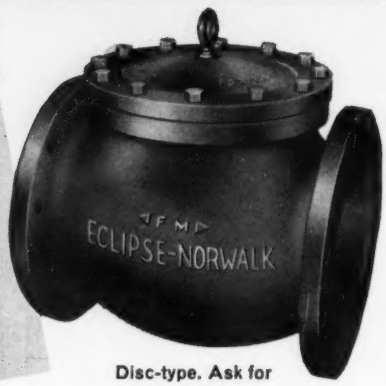
follow AGA recommendations with Eclipse-Norwalk check valves

Protection against reverse flow in gas lines. Part #4 Sec. 4.28 (A) "When gas equipment is to be installed which employs air or other gases at higher than normal gas pressures, suitable provision shall be made to protect against reverse flow of air in gas lines."



Disc-type. Ask for Bulletin MN-1000

Use Eclipse-Norwalk disc-type check valves in gas lines for full compliance with this standard. Horizontal or vertical operation. Aluminum discs standard (temp. to 200° F) — stainless steel discs (temp. to 400° F) available. Top entry to valve simplifies inspection and maintenance. Screwed or flanged construction from ½" to 16". FM approved.

Protection against supply pressure drop. Part #4 Sec. 4.28 (B) "When gas compressors or other equipment are used which might reduce supply pressures, suitable provisions shall be made to prevent dangerous pressure reductions on the inlet side of such devices."

Diaphragm-type. Ask for "Meter Cop" Bulletin MN-4000

Use Eclipse-Norwalk "Meter Cop" diaphragm-type back pressure and anti-suction valves. Soft seats assure positive shutoff with back pressures to 50 psi. Sizes from 1" through 6" screwed or flanged cast iron construction. Handle 500 to 10,000 cubic feet per hour. 1" WC vacuum shutoff standard. Temperatures to 200° F. FM approved.

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Men at Work

E. F. Hyland

Carl von Linsowe

● Recent personnel changes at J. I. Case Company include: Appointment of **Edward F. Hyland** as general supervisor of public relations; he was formerly manpower director for the company. **Carl vonLinsowe,** former manager of engineering, of the Churubusco, Indiana Works plant has been appointed director of engineering—industrial products. **Frank Lipari** has been appointed manager — the Stockton plant succeeding **T. J. Garbeff** who has been transferred to the general office in Racine, Wisconsin. **A. Earl Lee** has been appointed marketing coordinator for all phases of product development and market research. **William Ewing** has retired as director of the company after serving on the board continuously for 40 years; he is a partner in the firm of Morgan Stanley & Co., New York investment bankers. **H. Edward Vollmers,** also a partner in Morgan Stanley & Co. has been elected a director to fill the vacancy.

● New board member of Ohio Fuel Gas Co. is **George Pope MacNichol, Jr.,** president of Libby-Owens-Ford Glass Co. He is also a director of Columbia Gas System, Inc., parent company of O-F.

● Named to fill the new position of vice president of Cities Service Gas Co. is **Charles T. Klein,** manager of the natural gas division of Cities Service Oil Co., Bartlesville.

● Newly-elected director of public relations for the Instrument Society of America, **Ira S. French,** was formerly account executive in Ketchum, MacLeod & Grove, Inc., Pittsburgh advertising agency.

● **Robert E. Johnston Jr.** has been appointed assistant sales manager of Cal-Metal Pipe Corp. of Louisiana. He was formerly southern district sales manager.

● Schramm, Inc., West Chester, Pennsylvania, has appointed **John R. Mills** as sales manager of the Rotadrill Division.

Deaths

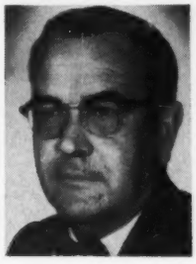
Leland Olds, 69, former FPC Commissioner, died August 3 in Bethesda, Maryland. He served on the Federal Power Commission from July 7, 1939, until June 22, 1949.

Robert H. Whipple, 76, former assistant to the manager of Philadelphia Electric Company's gas department, died on August 18. He had retired in 1955 after 47 years with the company.

J. R. Woodfill, 51, manager of industrial gas sales for Northern Indiana Public Service Co., died August 27 at his home in Highland, Indiana.

● **Hellmuth "Dick" Strauss** is returning to Walworth Company, where he had served as executive and board member for more than 25 years before leaving in 1957. He will be vice president and general sales manager. **Harold Brown,** who formerly held this title, has resigned.

Hellmuth Strauss



J. R. Campbell

● Named gas trouble supervisor for Arizona Public Service Co.'s metropolitan division is **James R. Campbell,** former gas utilization specialist. In the newly-created post Campbell will be in charge of maintenance of gas refrigeration, gas post lights and major gas trouble such as breaks in mains and services.

● New assistant area development manager for East Ohio Gas Co. is **William R. Smith,** formerly with Detroit Edison Co. In the newly-created post, Smith will assist **W. R. Pringle** in a program of publicizing advantages of industrial locations in northeastern Ohio area.

● **Robert A. Himmelmann** has been named assistant manager of the industrial sales department of The People Gas Light and Coke Co. He was formerly director of the industrial utilization section of the department.

● Lone Star Gas Co. has appointed **Homer L. Payne** assistant treasurer succeeding **John C. Bridges,** who retired February 29 under the company's pension-insurance program. **Morgan Jones, Jr.** of Abilene, has been elected a director of Lone Star, replacing the late Thomas H. Hislop.

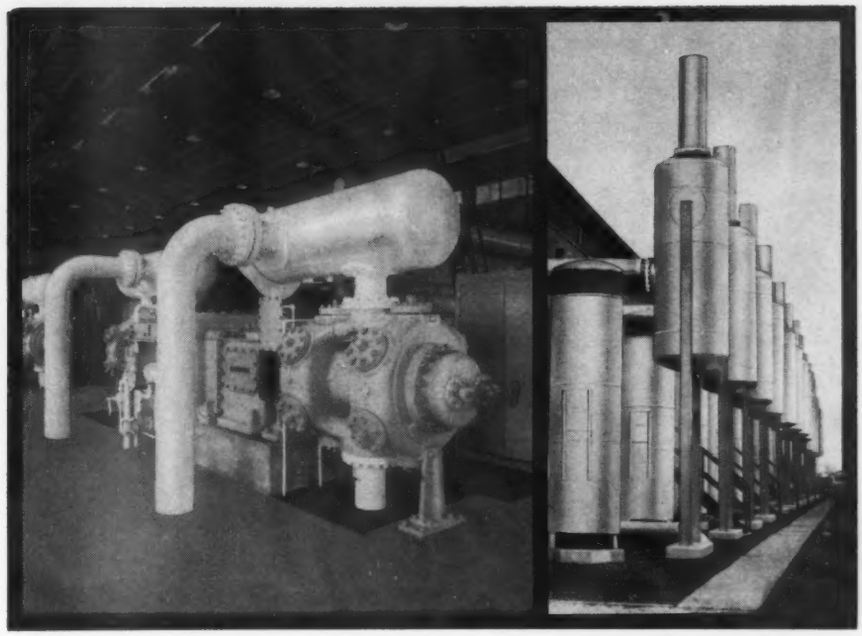
● Re-elected to three year term as directors of Northern Indiana Public Service Co. were **Walter A. McDonough** and **James S. DeLaurier,** of Hammond and **Walter W. Walb** of Fort Wayne.

● **Vincent P. McDevitt,** vice president and general counsel, has been elected a director of Philadelphia Electric Co.

● Dearborn Chemical Co. has appointed **Glen R. Pierce** manager of the newly-created distributor sales division, set-up for sale of company's maintenance protective finishes, air conditioning supplies and electrical tapes. Also announced was promotion of **Samuel Kruty,** former assistant production manager, to production manager of Dearborn Chemical to head-up manufacturing operations for all company product lines.

● **Gustave G. Amsterdam,** chairman of the board and president of Bankers Securities Corporation, has been elected a director of Philadelphia Electric Co.

● Washington Natural Gas Co. has elected **Harry F. Smith** of Omaha, Nebraska, to its board of directors. Smith is a partner in the firm of Smith, Polian & Co. of Omaha.



ELIMINATE PULSATION AND NOISE WITH BURGESS-MANNING SNUBBERS

Burgess-Manning Pulsation Snubbers are the most effective control measures available to eliminate excessive vibration. Equipment performs better, operating and maintenance costs are reduced, breakdowns and repairs are fewer, and even structural damage to buildings and foundations is prevented. Similarly, when a Burgess-Manning Silencer is installed to eliminate excessive noise, employees work more efficiently, with fewer accidents and errors, production is usually increased, and a plant's labor and community relations are improved. ■ If noise or vibration from the intake or discharge of pressure regulators, blowers, turbines, internal combustion engines, compressors, gas or steam vent valves, and similar equipment is a problem with you, contact Burgess-Manning. Nowhere in the world will you find a company better qualified, with more experience, a better engineering background, and a wider range of products for noise and pulsation attenuation. *Pictured: Burgess-Manning Pulsation Snubbers, Filter-Silencers, and Exhaust Silencers on gas-driven compressors in petroleum pipe line station.*

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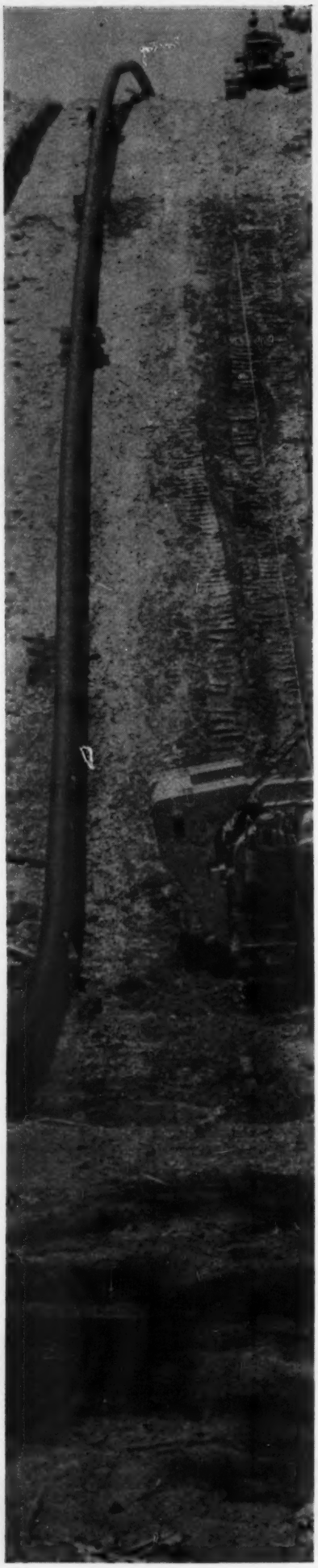

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Men at Work

J. E. Murray

H. E. Braunig

● Central Illinois Electric and Gas Co., Rockford, Illinois, has elected **James E. Murray** chairman of the board and principal executive officer, and **Hubert E. Braunig** president. Murray succeeds **Donald C. McClure,** who has retired from active management but will continue to serve in an advisory capacity as chairman of the executive committee. Braunig moves up from executive vice president and succeeds Murray, who has been president of Central Illinois since 1953.

● **Jack S. Pettersen** has been appointed director of marketing for Norge Division of Borg-Warner Corp. succeeding **Walter C. Fisher,** who has been named Norge vice president of sales. Pettersen will direct all Norge home appliance merchandising operations, including advertising and sales training.

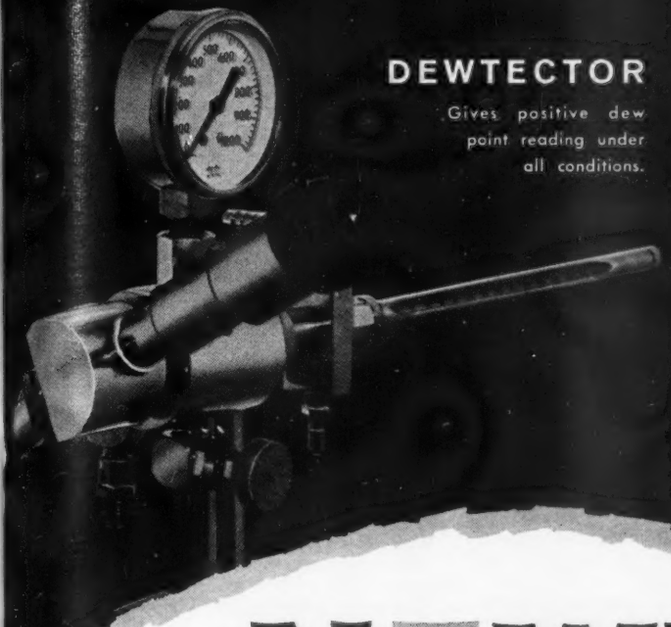
● **Howard Zellner** has been promoted to local plant and service foreman for Ohio Fuel Gas Co. in Ashland. In the new post he will supervise customer service operations, construction of new facilities, and maintenance of existing O-F facilities.

● **George M. McClure** has assumed **Dr. Horace J. Grover's** former post as chief of applied mechanics research for the Battelle Memorial Institute's Department of Mechanical Engineering. McClure will assume responsibility for the group of research specialists engaged in design and stress analysis, and in studies of fatigue and other properties affecting equipment design.

● **Emery Dee Hoenshell,** newly-appointed system manager of community services, will assist **Christy Payne, Jr.,** manager of market development, in carrying out Consolidated Natural Gas System's community betterment and industrial development program. Hoenshell was formerly director of the Duluth, Minn., Industrial Bureau.

● **James B. Cook, Jr.,** sales manager, general products division, Hays Manufacturing Co., has been named assistant director for mobilization planning of water and sewerage industry and utilities division, business and defense services administration, U. S. Department of Commerce. Cook comes to BDSA under an arrangement by which industry makes executive personnel available for temporary assignment without compensation from the government.

● **David D. Ackerman** has been appointed salesman for the New York metropolitan area for general products division of Hays Manufacturing Co. Ackerman was formerly associated with Ludlow Valve and Manufacturing Co. **Casimer (Cas) Michali,** who has traveled for Hays in the New York area for the past five years, will continue to represent the company in the area.



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United Gas Corporation — the world's largest handler of natural gas — stays ahead in research and instrument development through its newly organized UGC INSTRUMENTS Division. Research has been the key to many UGC operating problems: *safety*, *dependability*, *accuracy*, *economy* and *speed*. Whatever the problems in the utilities industry... gas, electric or water... UGC INSTRUMENTS is solving these problems with instruments that have been developed through research.

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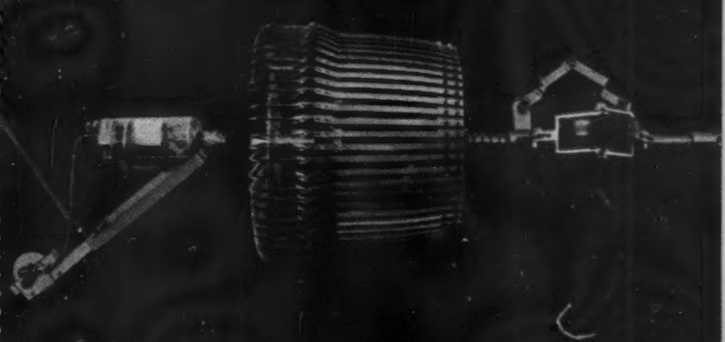
First portable digital tape recorder for meter reading. Completely automatic and weatherproof.

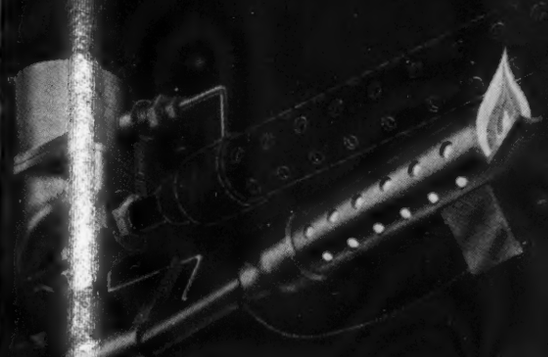


CORROSION DETECTOR

Locates, measures and records internal pipe corrosion.

VIGILANT

Assures safe, continuous heater operation on pipelines and producing equipment.



See these and other instruments developed by United Gas Corporation at the AGA Convention.

NEWSREEL

Peoples Natural Gas To Buy Small Pennsylvania Utility

Peoples Natural Gas Company, a subsidiary of Consolidated Natural Gas Company, plans to buy Union Heat & Light Company of Grove City, a small utility serving 7000 gas customers in Mercer, Lawrence, Venango and Butler counties, if the Pennsylvania PUC and Securities and Exchange Commission approve. Present officers of Union Heat & Light will relinquish their responsibilities when purchase is effective. However, Peoples Gas has named J. C. McFadden, present superintendent of the Union company as its manager of the new Grove City service area.

Shell Claims New Electrode Boosts Fuel-Cell Power Fourfold

Latest breakthrough in fuel-cell research is claimed by Shell Research Ltd., (Royal Dutch/Shell's Thornton Research Center at Cheshire, England), which has built a fuel-cell with a "radically different" electrode that develops about 4 times the power per unit volume of other low-temperature hydrogen-oxygen cells. Unit develops 3 to 5 kw per cu ft. At room temperature unit has a current density of 70 amp per sq ft; raising operating temperature to 60 C (140 F) doubles the current density. Cell uses acid or alkaline electrolytes, operates at 3 psig on air or oxygen. So far, hydrogen has been used as the fuel, but experiments have shown cell can use other types of fuels.

"Shell's interest in the fuel cell," says Dr. C. G. Williams, director and general manager of Shell Research, Ltd., "stems from the fact that the oil industry is a supplier of fuels, and no one has yet decided just what kind of fuel will best suit the fuel cell of the future." The research center has constructed a multiple-fuel-cell unit with up to 6 cells per sq in. Shell believes power-to-weight ratios of up to 50 watt per lb are possible with its new electrode. Best ratio to date for a low temperature cell is about 10 watt per lb.

National Fuel Gas Company Seeks Corporate Simplification

Two subsidiaries of National Fuel Gas Company propose to merge as a step in corporate simplification. Iroquois Gas Corporation of Buffalo, N. Y., plans to acquire and operate facilities of affiliate Penn-York Natural Gas Corporation for approximately $843,100. Penn-York is a transmission company selling all gas wholesale to Iroquois.

Columbia Gas Subsidiaries Realign Properties

Columbia Gas System is a step nearer its proposed realignment of properties so each operating subsidiary will be subject to jurisdiction of only one regulatory agency. FPC has finally approved the G-17,226 case — sale of Cumberland and Allegheny Gas Company's Maryland facilities to another affiliate, Columbia Gas of Maryland, Inc.; and Columbia is now seeking FPC approval of further realignment of its corporate structure in CP-61-60. The next move is sale of the Pennsylvania facilities, including distribution properties and some transmission lines, of Manufacturers Light and Heat Company to a new company, Columbia Gas Company of Pennsylvania. Manufacturers is to retain its producing and major transmission facilities and sell gas to the new distributor. Manufacturers has also asked for authorization to build 20 new metering stations estimated to cost $389,000 to effect deliveries to Columbia of Pennsylvania.

Grayson Controls Division of Robertshaw-Fulton Controls Company has construction underway in Long Beach, California, on a new 10,000-sq ft plant addition. The new $175,000 structure is in the form of a wing adjoining existing buildings. Scheduled for completion late in October, the new addition will provide additional engineering space for the design, development, and testing of new control devices.

New Distribution Company Formed in Colorado

Rocky Mountain Natural Gas Company, Inc. of Denver, Colorado, a recently-organized gas distribution company, has construction underway on a new 95-mile 8-in. natural gas system to serve Wellington, Walden, Nunn, Delta, Montrose, and adjacent areas in the Gunnison River valley in Colorado. Project, estimated to cost $2,350,000, consists of 30 miles of gathering lines in the Colbran, Colorado, area approximately 50 miles northeast of Grand Junction, and 65 miles of high pressure steel supply lines that cut south from Colbran across the Grand Mesa of Colorado. An estimated 77 miles of distribution lines are to be installed. H. C. Price Co. of Bartlesville, Oklahoma, is contractor on the project.

White-Rodgers Company, St. Louis automatic controls maker, has acquired the Burner Division of the Configured Tube Products Company, of Bellwood, Illinois, producers of burners for furnaces, clothes dryers, hot water heaters, gas ranges, incinerators, deep fat fryers, chicken brooders and other gas-burning applications. Configured Tube Products Co., known throughout the trade for its "Thermi-Jet" single port burners and venturi tubes, will continue operation as a White-Rodgers subsidiary. All products will be handled by White-Rodgers field sales organization.

Standard Oil Company (Indiana) and McGraw-Edison Company have joined forces for joint research and development on fuel cells. An initial 2-year agreement for the project, subject to renewal, calls for combining know-how in their respective fields of the Thomas A. Edison Research Laboratory division of McGraw-Edison at West Orange, N. J., and Standard's research and development department at Chicago and Whiting, Indiana. Standard Oil researchers will contribute their knowledge of catalysis, combustion oxidation, and hydrocarbon or petroleum fuel characteristics. The Edison laboratory specializes in electrochemistry, electrolytes, cell reactions, electrode construction and activiation, and electro-chemical cell construction.

Kraloy Plastic Pipe Company, subsidiary of Rexall Drug and Chemical Co., has opened a new warehouse in Dallas. A complete line of PVC pipe, valves and fittings for use in gas utilities is now available. Robert R. VanDine, top, is district manager, and Clay H. Hesse, is manager petroleum industry sales.

Dearborn executives survey new plant site — R. H. Norris, center, president of Dearborn Stove Company, manufacturer of heating and cooling equipment, is shown surveying the company's new 30-acre plant site in Dallas' Garland Industrial District. Planned is a new $1,500,000 manufacturing facility with tentative groundbreaking date set for January 1, 1961. In addition to full line of gas area heating units, air coolers, and outdoor cooking equipment presently manufactured in Dallas, the new Dearborn plant will also manufacture complete line of gas-fired central heating equipment, which accepts air-conditioning. With Norris, left to right, are Charles Struwe, secretary-treasurer of the firm, and E. S. Kleinmann, vice president, sales.

Carmen Logana, (left) foreman of meter shop, and J. Dugan, superintendent of Gas Measurement, Niagara Mohawk Power Corporation, Syracuse, N.Y.

"None of our Reeves-Vulcan synthetic diaphragms have ever needed replacement in OVER TWENTY YEARS!"

"Over 72,000 of our active meters are equipped with Reeves-Vulcan synthetic diaphragms," says Mr. Dugan. "In our new stepped-up program of meter maintenance – in which we can process 10,000 meters a month – we have ample opportunity to check the performance of these Vulcan diaphragms.

"As our meters come in for their seven-year check-up, the only diaphragms that need replacement at present are leather. None of the Vulcan synthetic diaphragms have needed replacement. This applies to those that were installed over 20 years ago.

"We have found that synthetic diaphragms sustain meter accuracy much better over long periods of time than leather diaphragms. That's why all our replacement meters are equipped with Reeves-Vulcan synthetic diaphragms. As the number of these diaphragms in use increases, we find a decrease in the number of meters that need adjustment."

How about *your* meter efficiency? You can get greater accuracy, longer service life and lower maintenance costs with Reeves-Vulcan diaphragms. There are models for practically every type of gas meter made. Both molded and crimped styles are available in any volume. Order Reeves-Vulcan synthetic diaphragms from leading meter manufacturers or directly from:

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Brooklyn Union Gas Company plans to change the format of its employee magazine from a weekly newspaper to a monthly magazine style. Titled *"Sendout,"* the new publication, termed experimental and with a life "for at least three months," will replace the 35-year old *"Gas News."* Editor Mary A. Coffey, who continues as editor of the new monthly notes significance of the new title, industry's term for the daily, weekly, and annual, or amount of gas distributed to customers is apt for the new magazine which will aim at "sending out" gas company news to employees. September 2 marked the 1835th time *"Gas News"* had been published since it was originated in the New Business department of Brooklyn Union in 1925.

New external publication for gas distribution company customers and stockholders makes it appearance this September, C. S. Stackpole, A.G.A. managing director, has announced. Titled, *"Wonderful World,"* the new magazine will be produced four times each year by the Creative Division of the Manz Corporation, pioneer Chicago printers who specialize in preparation and production of sponsored external magazines. The magazine will cover newest developments in home heating, gas appliances, food preparation, and general family living. Sheldom Widmer, senior vice-president of the corporation, Richard M. Ray, vice-president, and Richard L. Conover, formerly general promotional manager of Equitable Gas Co. in Pittsburgh, will be responsible for future development of *"Wonderful World,"* and will participate in preparation and production of catalogs displays, dealer helps, and collateral materials.

Preparation for a new data processing system — a Honeywell 800 — is underway at Philadelphia Electric Company. A new systems and data processing department has been established within the finance and accounting department to centralize all machine processing, on the electric computer and on punched card tabulating equipment for accounting activities, and all other departments of the company. The new Honeywell 800 data processing system recently ordered by Philadelphia Electric culminates a 4-year program of system design, determining feasibility, and selection of equipment. The new system will have 8192 words of memory with eight on-line tape units. All peripheral operations will be offline. Three 900-line/minute printers, two 650-card/minute readers, and 250-card/minute punches will be included in the system.

Delivery date on Connecticut Light and Power Company new IBM 7070 data processing system together with two IBM 1401 systems has been set for December 1960. The entire 7070 system, including console control unit, arithmetic and program control, core storage control, core storage, console card reader, power converter, input-output control, tape control, and 13 tape drives, has been purchased.

Consumers Power Company is taking a "good look" at its customer billing procedures and with an eye on speeding up the process, has ordered a Farrington Optical Scanner Model 1D3C unit to scan stubs of its laminated post card bills. The new equipment, delivery expected by early 1962, will simultaneously scan two lines, up to 35 characters per line, pick up 22 characters of information from each returned stub, assemble, and pack the scanned information from three stubs along with 10 characters of indicative data (batch number and date) into one record on an 80-character, 2-stage magnetic drum buffer. This information will then be punched into an 80-column card. Effective speed of the operation — approximately 275 input documents per minute — will approach, if not equal, that of magnetic tape output system.

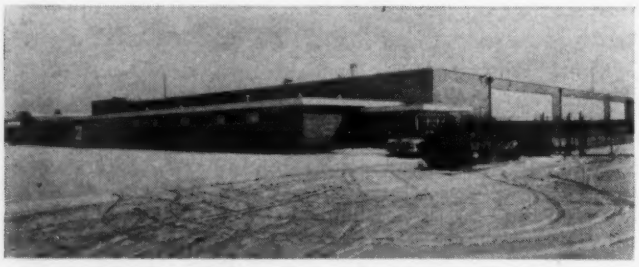
Lennox Heating Company Ltd., is the name of newly-announced subsidiary of Lennox Industries, Inc. which will begin operations in the near future in England. Initially, the British firm will sell one gas-fired and one oil-fired furnace, each delivering 50,000 Btu. Heat exchanger design will follow the tested "wrap-around" radiator concept. Both models will be upflow with belt-driven blowers; subsequent furnaces will be down-flow in same 50,000 Btu output. These furnaces will be produced at first on the Toronto, Ontario, plant of Lennox Industries (Canada) Ltd.; however, plans for manufacturing in Britain are now under consideration. Heading the new subsidiary will be Robert B. Trezevant, former plant manager at Lennox Industries; Columbus, Ohio, headquarters.

Battelle Memorial Institute, Columbus, Ohio, has just begun a long-term research program to advance fuel-cell technology. Described as "a major research effort being underwritten by some 25 companies," the program is currently on a 5-year schedule, will be fundamental in nature, and designed to complement existing government, industrial and academic studies on fuel cell technology. Dr. John McCallum, project director, notes that before fuel cell's full potential can be realized as a source of power for automobiles, domestic heating and cooling, and industrial process, there will have to be a number of inventions, innovations, and breakthroughs. "Battelle," he said, "with its diversity of scientific disciplines, hopes to contribute to this process of discovery."

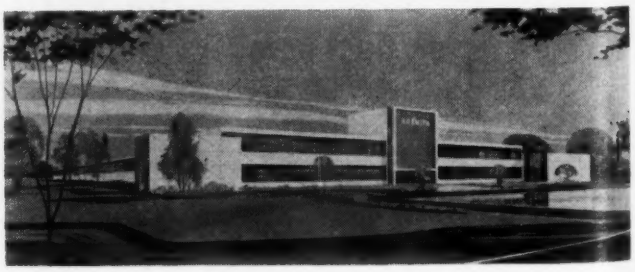
Extended service is one of the many advantages ascribed to the fuel cell as a source of energy. Prime advantage is the remarkable efficiency with which it converts fuel to energy. Efficiencies of 75% have been demonstrated in experimental fuel cells as compared with 40% in steam turbines, 35% in diesels, and 25% in spark-ignition engines.

Rockwell Manufacturing Company plans a $500,000 physical expansion program for its Hopewell plant that will consist of a two-story, 30,000 square-foot addition to the present building providing the plant with better control of material handling, added production facilities and allowing more economical manufacturing. The new addition will increase the plant from 73,000 square feet to more than 100,000. The plant produces service cocks, meter registers, and machined meter components for such Rockwell products as water meters and chart drives.

Free radicals as power source? Energy Conversion Laboratories of Detroit, a newly-organized company headed by Stanford Ovshinsky, maintains it has — on a lab scale — harnessed energy of free radical recombination and can soon achieve compact, self-contained, mobile power packages for a wide variety of down-to-earth applications. Such devices, Ovshinsky says, will produce radicals from diatomic gases via high-energy radiation and convert 90% of the recombination energy to electricity on surface of thermo-electric material — at "near room temperatures." Currently used techniques for capturing and storing free radicals require cryogenic temperatures. Among practical devices Ovshinsky visualizes as result of company's new development program, are electric generators for remote regions, power plants for boats, autos, other vehicles, steam generators for seawater desalting units.



Controls Company of America, in a bid to streamline manufacture of its heating and air conditioning controls, and provide for future expansion, has acquired a former Chain Belt Company ordnance plant in the Milwaukee area. The plant is an 8-year-old modern one-story building of brick and steel, contains 65 000 sq ft of floor space, and is located in Wauwatosa, a Milwaukee suburb. Plot is slightly larger than seven acres. Company also plans to buy 82,800 sq ft of adjoining property as a provision for future expansion. Currently, the company has its heating and air conditioning division in two Milwaukee plants—one on North 31st Street, the other on 32nd Street.



This is artist's concept of how A. O. Smith Corporation's new $2,000,000 advanced Research Center at Middleton, Wisconsin, will look when completed next year. Ground is to be broken for the project this fall on 80-acre tract of land on the northwest edge of Middleton; advanced research activities in the new facilities are planned to start by the middle of 1961. Preliminary plans call for construction of a 50,000 sq. ft building of modern design to house company's initial research group of approximately 50 scientists and technicians. Ultimately a staff of approximately 100 scientists and highly skilled technical people will be employed on various projects.

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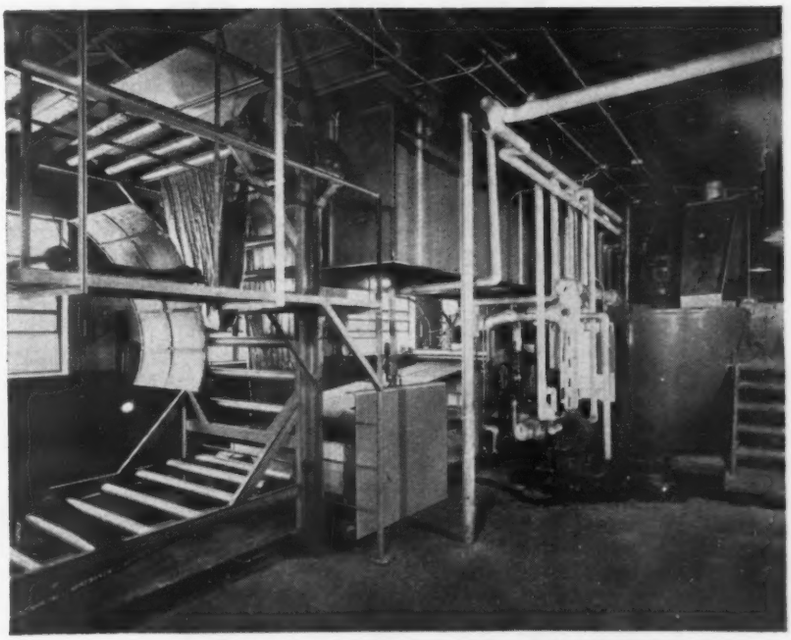

View of specially-designed machine developed after five years of research by Tapecoat engineers to convert raw materials automatically into TAPECOAT 20.

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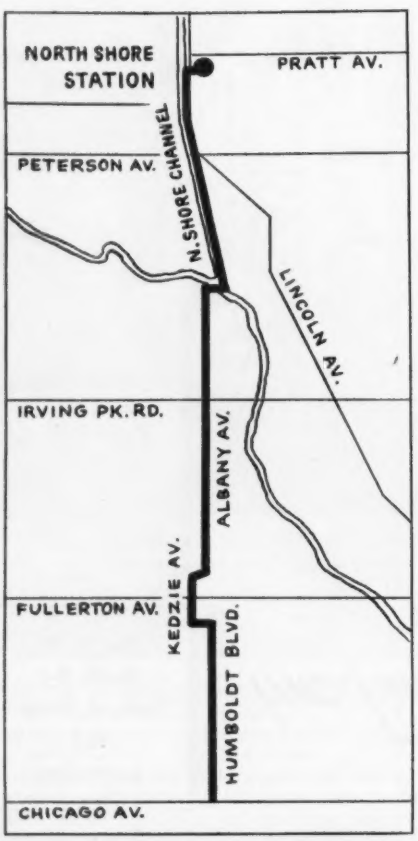
In residential areas, where vehicle gross weight is often restricted to 5-ton limits, rubber-tire-mounted equipment is essential. Contractor utilizes such equipment fully to install new 36-in. Interstation Main for Peoples Gas Light and Coke Company in Chicago.

36-IN. WIDE, 29-MILES LONG . . .

To Lay a Giant Main, You Plan on Gigantic Scale

AGJ Staff Report



Route of 1960 portion of the 29-mile Interstation Main in Chicago.

LAYING A 36-IN. STEEL GAS MAIN 29 miles through the heart of Chicago is a large undertaking. An even bigger undertaking for a three-year, $23,000,000 project is the advance planning, coordination, and supervision for the project.

Although an outside contractor, laying the northern portion of the main in 1960 under supervision of The Peoples Gas Light and Coke Company engineers, will require about six months to complete this phase, preliminary work required even more time — nearly a year.

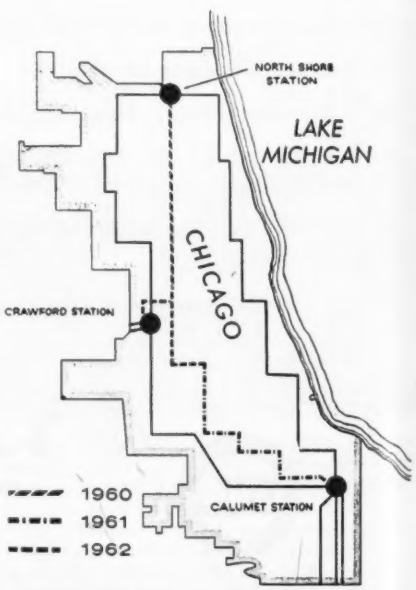
This included, in addition to the engineering detail necessary for the project, coordination between several company departments, the contractor, two other utilities, and city departments as well as consideration of various customer and public relations aspects.

Need Determined

Market projections and engineering studies in recent years indicated the need for a new line to increase the capacity and flexibility of Peoples Gas' present distribution system in Chicago. These studies showed that a 36-in. main connecting the three natural gas supply points and the interconnecting mains between a 48 and 36-in. line that encircles the city, would provide the necessary additional capacity.

One of the first steps in designing the line was to project a temporary route on a large Chicago street map. Streets that appeared to be most feasible for construction were selected for this tentative route.

The line would require a trench



Route of the complete line and three phases of construction.

Tunneling 36-in. line under busy arterial intersections minimizes traffic disruptions. Tunneling is done by hand, line goes through a 5-ft by 5-ft "box" at depths down to 35 ft below street level. Above, "Payloader" is used to tamp backfill on near-complete crossing.

Manifold for district regulator station is coated and wrapped prior to installation in adjacent regulator vault. Coal tar tape is used on regulator station piping. Coating for 36-in. main includes two passes of coal tar enamel, glass fiber inner wrap and glass fiber overwrap.

nearly 5 ft wide and about 7 ft deep. The principal feasibility test for the tentative route included such things as traffic flows on those streets selected and the crossing arterial and secondary streets.

After the tentative route was mapped, engineers "rode" the streets to verify earlier conclusions. Changes determined necessary by the personal survey were made.

Mapping

Next, numerous maps of the area showing underground facilities of other utilities and certain city departments were obtained.

These maps were studied and facilities such as electric and telephone installations and water and sewer lines in the route were noted and transposed onto the Interstation main map.

Peoples Gas facilities maps also were reviewed to determine not only what existing facilities lay in the route of the big new gas main, but also which of these would have to be relocated.

Test Holes Dug

Then crews worked for nearly three months digging numerous test holes in the streets involved to verify accuracy of data and to check on tolerances between the proposed and existing facilities.

Final preliminary engineering step was to investigate all manholes along the route and then accurately locate them on the tentative map. After this data was assembled, the final route was selected.

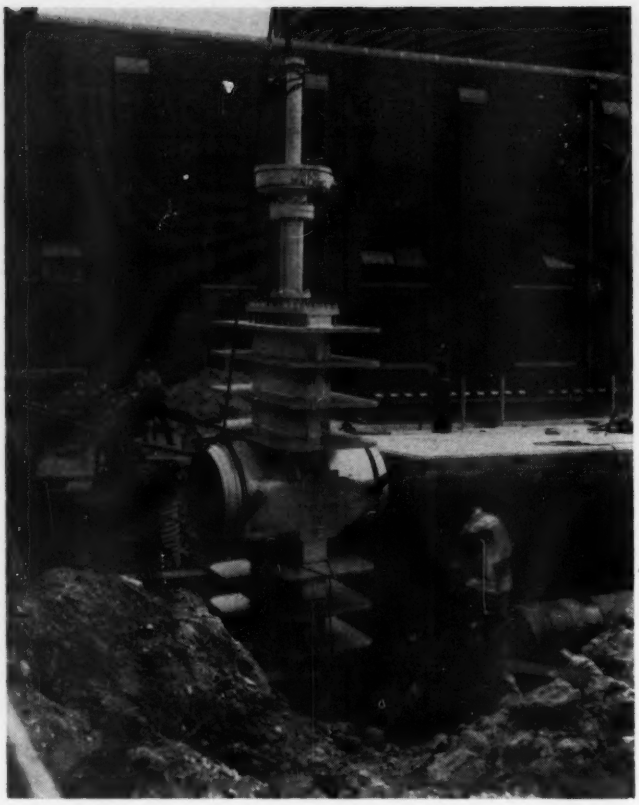
Design of Line

Next step was to design the proposed facility. Drawings and specifications meticulously detailed the project, which included for 1960 about 42,000 ft of steel main, main connections, regulators and vaults, station piping, and regulation and flow control equipment. ASA Code requirements and Peoples Gas experience were the design standards.

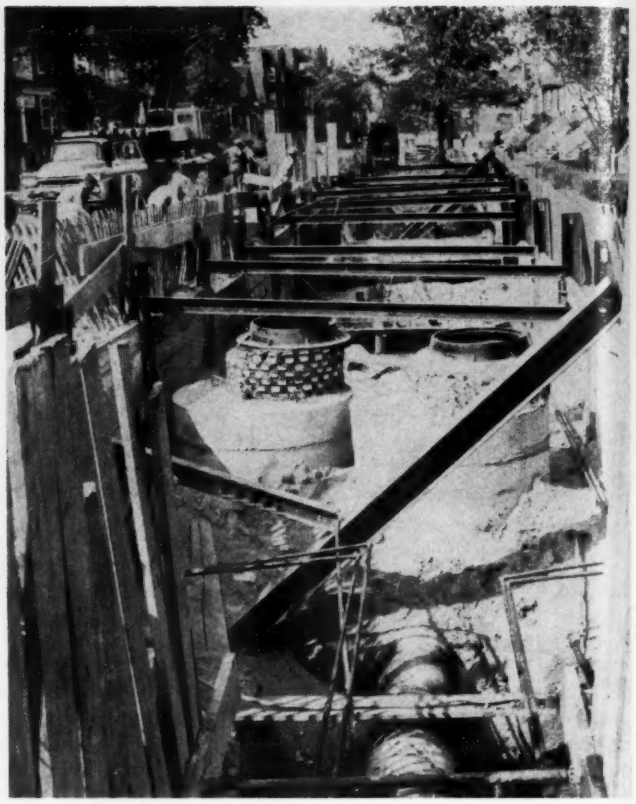
A total of 53 individual construction

Installed street crossing goes down through tunnel and smoothly makes a 90-degree turn using 45-degree fitting segments cut from long radius 90-degree perfect round elbows. Maximum curvature of 45-deg. was necessary to permit passage of spherical "pigs" during hydrostatic testing operations.

Crossing North Branch of Chicago River was major project in itself. In addition to regular coating and wrapping, the 36-in. pipe received an outer coating of concrete reinforced with steel wire to a 7-in. thickness, to assure negative buoyancy. Line had to be laid with provisions for possible future widening of river channel. Steel sheet was driven in bank at three points to prevent loss of backfill.



Biggest valve of its type ever made is installed at North Station. Valve weighs 10 tons, marks beginning of 1960 section of new 36-in. Interstation main.



District regulator installation lies in middle of residential street. When completed, only evidence of the station will be manhole covers at street surface.

drawings were made for the 1960 phase — 26 for the main line, eight for regulators and vaults, and 19 for small connections, taps, vents, etc. Innumerable sets of prints were made from the basic drawings.

The drawings then were submitted to the Board of Underground Work of Public Utilities of Chicago, a coordinating unit, so the city and other utilities could become familiar with the project.

Many Permits Required

Then, permit applications were filed with the various governmental agencies requesting authority to proceed. Drawings also were submitted with these applications.

To cross the North Branch of the Chicago River, the company needed permission from the City of Chicago, the Water Ways Department of the State of Illinois, the Chicago Sanitary District, and the United States Army Corps of Engineers. Design of the crossing of this stream at Ainslie Street had to take into consideration a Sanitary District plan to widen the river at a later date.

A Chicago Park District permit had to be obtained to build the line through the several parks in the right-of-way, and an easement was negotiated with the Sanitary District. City of Chicago authority to lay the line in streets also was needed.

While these applications were pending, the engineering department drew up lists of material required for the 1960 phase of the Interstation main so the purchasing department could place orders to coordinate deliveries with the start of work.

Detail plans and specifications also were submitted to the purchasing department so outside contractors could bid on the job. Under the terms of the contract between the company and the successful bidder, the contractor agreed to indemnify the company from all claims of damage that might arise from work directly related to the Interstation main performed by the contractor.

Preliminary Work

Before the successful bidder could start work, about 1½ miles of a 6-in. company main lying in the route of the Interstation main had to be relocated. The section to be relocated lay in Albany Avenue between Argyle Street and Logan Boulevard. This meant that a new main would have to be laid in the parkway in this area and that all gas services would have to be disconnected from the old main and reconnected to the new main. The relocation work was accomplished by Peoples Gas shop personnel.

Arrangements had to be worked out with other utilities and with the city water and sewer departments to have crews work just ahead of the contractor laying the Interstation main. They were to relocate water services and sewer lines, where necessary, to homes along the route. Every home lying on both

Prior to backfilling, sewage line is replaced with sewer tile carried on steel support. Temporary gas line — flexible hose — will be replaced with new steel service.

BEFORE . . . forested portion of Chicago Sanitary District property adjoining a residential area prior to installation of 36-in. main. Area has dense underbrush, lots of rocks, cluttered appearance.

AFTER . . . appearance of same area after installation of main is much improved, has clean sparkling look. Adjacent alley and garage driveways received new surface of crushed stone, entire area was reseeded with grass.

sides of the right of way had a minimum of gas, water and sewer services extending to them from the underground facilities in the streets. Some of these service lines were placed over the gas main, others under it. In addition, several water mains had to be relocated.

"Tight Specs" Necessary

All of these details had to be written into the specifications of the project, as well as many others. For example, the contractor is required to give all possible consideration to the preservation of trees within the right of way. In one area, the route of the line was moved about 20 ft to avoid nearly 50 trees.

The contractor also is charged with the responsibility of hiring a suitable landscaper to properly trim all trees whose branches extend over streets where the trees concerned are liable to be damaged by heavy equipment. Pipe fittings awaiting installation must be placed so they do not block intersections, sidewalks, or driveways and are braced to protect passersby.

Earth from the trench for the line is required to be hauled away immediately. Trucks are loaded so as to eliminate the chance of earth spilling out as they travel over streets. Mechanical sweepers are required to keep the areas as free from dust as possible.

Backhoe cuts trench, deposits material in waiting dump truck for removal from area.

Construction Details

Pipe for the 42,000 ft of main laid in 1960 is double random length 36-in. diameter X-46 grade, with a wall thickness of .375-in.

Protective coating consists of a coal tar enamel with a glass fiber inner wrap and a glass fiber overwrap. Two enamel passes were made. Coating, except for field joints, was made at a nearby yard and the coated and wrapped pipe was trucked to the job site.

The pipe is also internally coated, using an epoxy base coating, to provide protection against internal corrosion.

Due to the many bends required to snake the line in, out, down and around street, highway, railroad, and other utility crossings, a large number of 36-in. fittings was required. Fittings were specified in preference to field bends. In the line, the largest fitting (in degrees of curvature) is 45°.

Peoples Gas' design and construction engineers came up with a time and money saving method to provide an adequate supply of fittings . . . by purchasing long radius 90° fittings and slicing them to fit specific requirements. Biggest problem using this method is to obtain fittings that are perfect rounds throughout the curvature, i.e., at any point where the elbow is cut, the fitting as cut must be a perfect 36-in. circle.

Four methods of trenching are being employed on the route of the line through the congested area. Where possible, a ditcher equipped with a long boom is used. The boom is required so that dump trucks can be loaded directly as the ditcher moves down the right-of-way.

Backhoes are used in other areas to cut the trench in the street and prove ideal for ripping up the pre-cut paving slabs and initial cover. Material removed is loaded directly into dump trucks to be hauled away.

In some areas, further cleanout of the ditch is made by using clamshells on the rubber-tire mounted cranes.

Hand ditching is important in the final stages of the trench preparation, particularly where many utility lines are encountered—including gas, water, and sewage lines.

Shoring of the trench is accomplished using 4-in. by 12-in. lagging braced with steel H-beams. This method has proved especially successful.

As the trenching operations progress, a special crew goes to work making temporary gas connections using a flexible hose. After the 36-in. main is installed, this temporary hose is replaced with a new steel service.

The crew also replaces water lines as they are cut, installing a new lead water service that goes down and below the

Line-up clamp in place, welders lay stringer bead to tie together pipe sections just outside a street tunnel.

In parkway, where damage to pavement is not a factor, crawler tractors with sidebooms are used to lower-in the main into open cut ditch. Normally, where possible, 3, 4 or 5 joints are welded into one section on bank before installation.

Working in residential streets, cranes mounted on rubber-tire carriers are used for lowering-in pipe, other heavy-duty chores. Lowering-in here involves removal and replacement of cross-braces on shoring.

big gas main. This is a permanent installation.

Sewage lines are replaced temporarily with Transite pipe. After the big main is installed, a permanent replacement is made with sewer tile carried on steel angle supports.

Three regulator stations are included in the 1960 phase of the construction. One is located in the middle of a residential street, one in a park area, and the third in an off-street location.

Through these stations, the Interstation main will supply the company's intermediate pressure grid system, which operates at approximately 15 psi. Pressure in the 36-in. Interstation main initially will be about 40 to 45 psi.

Safety and Public Relations

Snow fences, made of wire and wooden pickets, usually put up in open country in the fall to prevent drifts on the highways, where required in Legion Park, Humboldt Park, and other areas along the right-of-way of the line to protect citizens using a swimming pool, playing ball, picnicking, or just "sidewalk supervising" within a few feet of the heavy construction machinery.

Temporary bridges of heavy gage steel plates are placed over the trench at all driveways and alleys to provide safe pedestrian and vehicle crossings and at all intersections and business establishment entrances.

Fences and other improvements removed to make way for the line are restored by follow-up crews. Hedges, shrubs and trees must be replanted and all grassed areas reseeded or sodded.

Paving crews follow the construction gangs where the line has been completed and repave streets, curbs, and sidewalks as fast as possible to restore areas.

Hydrostatic Testing

The 1960 portion of the line — as with all sections—is being hydrostatic tested after completion. This is being done in two sections—the first section being the portion of the line between the North Shore Station and the North Branch of the Chicago River.

The second test, the longest section, will be between Chicago Avenue and the North Branch of the river.

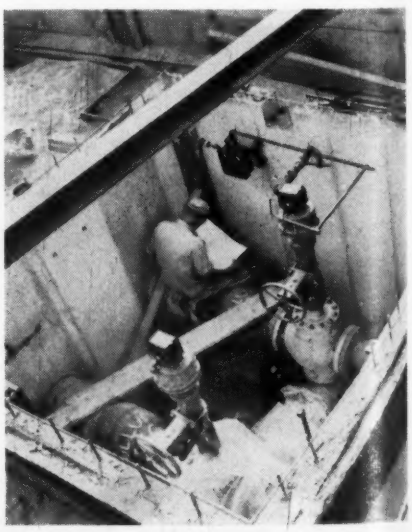
Approximately 2,500,000 gal of water is required for the tests. Water is taken from the stream, filtered, put into the line, the line pressured, and the water is then returned to the stream.

After testing, the street will be reopened in three places to install sectionalizing valves at the district regulator stations.

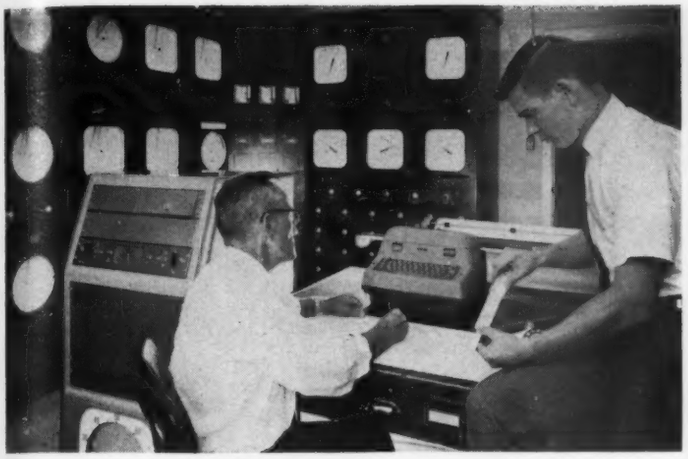
Spherical "pigs" are used in the testing to squeegee the internal pipe surface and aid in removal of water from the line after testing. Even using the spherical pigs, only 45° curvature in fittings could be allowed to permit the spheres to pass through the line.

Acknowledgments

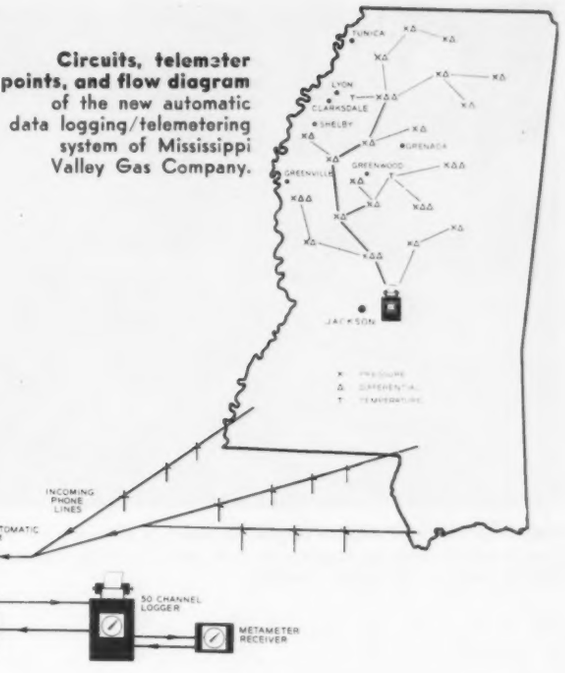
For their assistance and efforts in the preparation of this article, grateful acknowledgment is made to Dan Mowat, Ray Simmons, and Jack Cornelius of Peoples Gas' public relations department; to John Damm, supervisory engineer on the interstation main project; to Jim McNulty, of Contracting and Material Company of Evanston, Illinois, contractor; and to J. Lee Adkins, chief technical engineer, and V. F. Bittner, assistant chief technical engineer, Peoples Gas Light and Coke Company. * * *



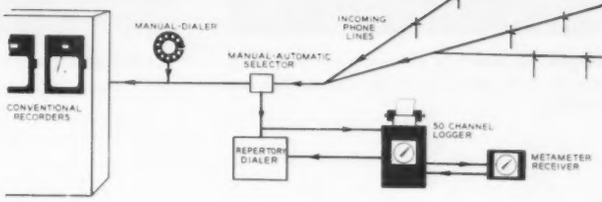
At district regulator station, workman studies plans for valve installation.



Main dispatch center in Jackson. Automatic digital logger is at left foreground. Seated at logging table is statistician George Vining. At right, operations clerk Homer Borden makes flow calculation from logged data. In background are meters, chart recorders, and cabinets housing telemeter system components.



Circuits, telemeter points, and flow diagram of the new automatic data logging/telemetering system of Mississippi Valley Gas Company.



At Mississippi Valley Gas Company . . .

Dispatching System Features Automatic Data Logging

Ralph Hurst, *Communications Supervisor*
Mississippi Valley Gas Company, Jackson, Mississippi

NEWEST "HELPER" in the dispatching office of Mississippi Valley Gas Company quietly works 24 hours a day without a complaint, takes a full set of pressure, flow, and temperature readings from 23 different stations as often as three times an hour, and is making the company's dispatching operations more efficient and economical.

Added recently to Mississippi Valley's unique telemetering system, the new helper is an unattended automatic digital logger that converts remote readings and types out data ready for use by dispatchers.

Information obtained from the automatic data logger is used as the basis for supervising total gas consumption on the system, and allows the company to take full advantage of available daily gas quotas without exceeding the amount stipulated in its contract with its transmission company supplier.

MV Pioneer in Telemetering

In 1953, Mississippi Valley Gas took a big step forward in gas delivery control with the installation of a new telemetering system that incorporated a manually-dialed selective calling of field stations as far as 200 miles away.

This system, developed by The Bristol Company and the Southern Bell and Telephone Company, permitted the dispatcher to dial any of 49 stations to obtain pressure, flow, or temperature indications on indicating receivers in the dispatching office panel. Telemetering equipment is Bristol impulse duration (5 sec) type. Selector units are located in local offices of the telephone company. Communications link between dialing and selector equipment consists of two half-duplex lines.

To this initial telemetering equipment, retained without modification, has been added a *Data-Master* logger, an automatic dialer, and a manual/automatic dialing selector.

The new arrangement permits maintaining an even closer degree of control on gas deliveries to the 66 towns and communities served by Mississippi Valley. The company's franchises extend over an area that ranges from the Tennessee border on the north down to Hollandale on the south, an overall distance of some 150 miles.

With more frequent checks of pressure, temperature, and flow available, curtailment of service to interruptible industrial customers during heavy demand periods can be delayed until the dispatcher is sure that the contract demand balance has been supplied in full. In effect, the company can now sell much closer to its allowable quota of gas from its supplier without incurring prohibitive penalties resulting when the supply is overdrawn.

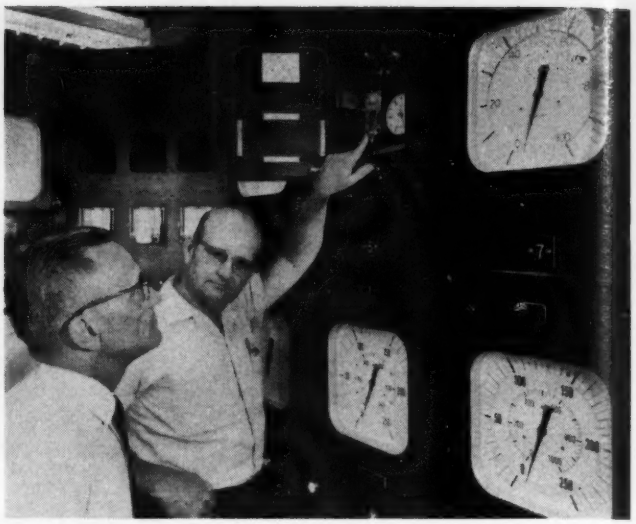
Mississippi Valley's contract specifies a daily quota of 62,000,000 cu ft. The company tries to stay within 90% of that volume (55,000,000 cu ft). Small penalties in the range of $1.50 per Mcf apply when 90% is exceeded, but these demand charges jump to as much as $10.00 per Mcf once the 100% level is exceeded.

On a year-around basis, about 60% of the total volume sold goes to residential consumers, with the remaining 40% divided among commercial, industrial, and governmental users. Normally, during heavy demand periods only the largest industrial consumers classified as interruptible actually have to be curtailed, and they are usually given two to four hours advance notice.

Less Cost, Better Control

The new telemetering and automatic data logging system provides accurate control over 92% of the areas served by Mississippi Valley. Material reductions in operating costs are achieved,

Upper portion of digital logger is shown in closeup view as Vining makes adjustments on logging interval control, which can be set for timing down to 20-minute intervals.



Communications supervisor Ralph Hurst, center, discusses operation of slidewire receiver with statistician Vining.

too, as the automatic equipment keeps a "round-the-clock" vigil, including weekends, at far less cost than would be incurred by manual operation.

During a typical 8-hour daytime shift, for example, it is theoretically possible to take a full set of readings manually every 15 minutes. If this is done, however, the operator has no time left for other duties. Under such strenuous operating conditions, it would be difficult to attract qualified personnel to work even during daytime shifts.

During the four months each year that a 24-hour-a-day, 7-days-a-week watch is required, the company estimates it would cost at least $2500 for two men to do it. Under such circumstances, a $15,000 investment in automatic equipment would be amortized in just five years on that basis alone.

In addition to eliminating expensive overtime charges, the automatic telemetering and data logging system also releases the operator for other duties, including the calculation of flow, integration and processing of charts, volume and pressure chart preparation, and numerous other important activities.

In effect, the equipment saves the company one extra man — an "iron man" who would have to withstand 16 continuous hours of duty. The new system allows one man to accomplish as much as three men could do without the system.

Additionally, the system provides substantially greater accuracy simply because it does not get tired and tend to misread figures at the end of a shift, as might naturally occur with a human operator. The automatic telemetering and data logging system operates at constant efficiency, which does not vary with weather, temperature, or other distracting elements.

System Development

As noted earlier, Mississippi Valley's telemetering system originally operated with a manually-dialed selective calling system that permitted the operator to dial any one of 49 points to obtain pressure, flow, or temperature data.

Each of the transmitters in the field is assigned a two digit code number. The dispatcher operates a three-position key at his desk, switching from "off" to "dial," then dials the appropriate number, and then moves the key to "meter" position. Lights on the instrument board indicate name of the town called and function being measured (pressure, flow, or temperature). A light also indicates the particular meter on which the reading appears. The dispatcher then records the information and moves the key to "off" position, which releases the equipment for the next number to be dialed.

New Equipment

Refinement of the system was made without any modification of the initial telemetering system, all of which was retained.

Additional equipment added included:

1. Data-Master* logger
2. Automatic dialer (by telephone company)
3. Manual/automatic dialing selector

There are five principal components of the automatic data logger. A Dynamaster* electronic self-balancing potentiometer with a slidewire receiver acts as the signal converter, changing the input electrical impulse to a shaft rotation. The instrument simultaneously indicates the value of the measured data.

An input programmer includes the input terminal board, input stepping switch, and the input program board. Input connections are made at the input terminal board. The input stepping switch sequentially selects the inputs and connects them to appropriate measuring circuits and other circuits as set up on the input program board. The input programmer connects to the signal converter measuring circuit, establishes the printing format (including decimal point location and spacing), and connects alarm circuits, including red ribbon shifts.

The analog-to-digital converter is driven by the Dynamaster balancing motor to convert the shaft position analog values into decimal data through contact closures on command from the output programmer.

This unit is analogous to a conventional counter mechanism, using rotating brushes in place of number wheels. One rotating brush is included for each of the three significant digits logged, with a bank of 10 stationary contacts for each rotating brush. At the readout signal (from the output program-

Telemetering transmitters relate flow, pressure, and temperature conditions from city gate stations as far away as 200 miles over telephone circuits.

mer), rotation is stopped and each bank brush is brought against the contact corresponding to its rotational position, each closure being a decade of the decimal output.

The output programmer is the main control unit of the data logger. This unit controls three functions:

1. Stepping of the input programmer;
2. Operation of the analog-to-digital converter, and
3. Feeding of output (digital) data to typewriter.

It consists of three basic parts — a control unit, which contains mercury wetted relays and associated circuitry to control operation of the switching unit; a switching unit, which consists of two 10-position stepping switches, one set controlling the sequence of operations during a single point printout and second set controlling the sequence of operations in a complete log cycle, and the output program board, which serves as a junction point for the control lines from the functional units of the logger.

Typewriter for the logger is a standard IBM Servotyper, which includes facilities (not presently used) for tape punching to record data simultaneously with typing.

Basic Operational Specification

Capacity: 50 points (maximum) with programmer moving "home" to initial position after 49th input channel is logged.

Logging Interval: 16 seconds per point.

Range: 0 to 100-in. water differential, 0 to 250 psi (also 0 to 500 and 0 to 1000 psi), and 0 to 120 F on temperature. Range for each point determined by input program board pins.

Input source: Common slidewire receiver recognizes a 0 to 100% of scale value only. Position of slidewire brush arm is determined by impulse-duration signal from remote transmitters.

Special switches. Contacts on output programmer to operate automatic dial system supplied by telephone company.

Power supply: 120 v, 60-cycle.

Clock: Digital clock permits printing of time at start of each logging cycle and also provides automatic timing that initiates each logging cycle.

Alarm: High and low limit contacts, common to all points, are connected to actuate to red ribbon to show abnormal readings. Switches are operated from contacts in slidewire receiver. Contacts are also closed in case of power failure.

Cabinet: Approximately 30-in. high by 42-in. wide by 22-in. deep, mounted on casters, with top suitable for normal placement of typewriter.

MISSISSIPPI VALLEY GAS COMPANY
JACKSON, MISSISSIPPI

TEXAS GAS TELEMETERING DATA LOG

CLEVELAND		SHELBY		BOLIVAR DISTRICT		DESOTO DISTRICT		GREENVILLE			GREENVILLE SO SYS		DEER CREEK DISTRICT		LELAND		INDIANOLA MASTER		GREENWOOD		CLARKSDALE		CDALE POWER PLANT		NEW CDALE FOWLER PLANT		
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
DIFF	PRES	DIFF	PRES	DIFF	PRES	DIFF	PRES	DIFF	DIFF	PRES	DIFF	PRES	DIFF	PRES	DIFF	PRES	DIFF	DIFF	TEMP	TEMP	PRES	DIFF	PRES	DIFF	PRES	
32	33	34	35	36	37	38	39	41	42	43	44	45	46	47	48	49	51	52	53	54	55	56	57	58	59	

Sample of data log, as recorded in dispatchers' office.

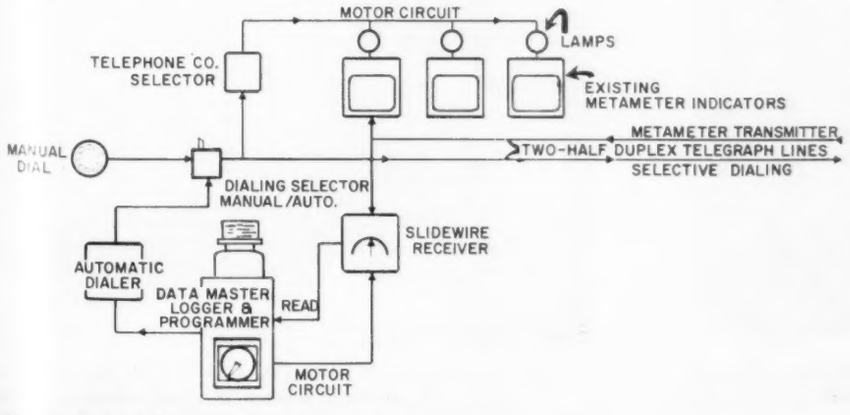
Operational Sequence

1. At predetermined intervals, output programmer causes automatic dialer to transmit a two-digit call number through dial leg of communication line. (Normally, interval timer is set for half-hour readings. Complete sequence requires 16 minutes to read all points, so minimum interval time is 20 minutes — three times per hour.)
2. Call number positions selectors in all telephone company offices in the system; only one selector has telemeter transmitter connected to selected point.
3. Transmitter responding to transmitted call signal sends back impulse-duration analog signal over meter log of communication line.
4. Pulse signal is received at all Metameter* receivers and at the slidewire receiver simultaneously. Because motor circuits of indicating receivers are controlled by the imput programmer, only one appropriate receiver has an energized motor receiver; other receivers, therefore, are unable to respond to the signal.
5. After Dynamaster potentiometer circuit balancing is achieved in response to this signal, the signal is read from a shaft position (whose rotation is determined by the Dynamaster instrument's servo motor) and converted to a digital code by the analog-to-digital converter.
6. Digital code is transmitted to the typewriter unit, where proper printing solenoids are energized to produce the digital log.
7. Feedback signal from typewriter "homes" unit after printing and logger initiates cycle for next point.

Manual/Automatic Feature

In event the data logger fails to function properly or is off-line for maintenance, the dispatcher can manually record data from the various points being telemetered.

This is accomplished simply by moving a switch on the cabinet control panel from "automatic dialing" to "manual dialing." The dispatcher can then dial manually each of the various points and read the telemetered values on appropriate meters. Whether unit is on automatic or manual dialing, the meters indicated the telemetered values as received. * * *



Schematic diagram of automatic logging circuit.

*Metameter and *Dynamaster* are registered trademarks of The Bristol Company Waterbury, Connecticut. *Data-Master* is a registered trademark of the Data-Master Corporation (formerly Hanson-Gorrill-Brian, Inc.) Glen Cove, New York.

Oklahoma man devises new load builder . . .

The Automatic GAS Coffee Maker

The New Gas Way

Edwin I. Mulcahy, service and utilization supervisor for Oklahoma Natural Gas Company at Tulsa, shares one habit with thousands of his colleagues: He frequently sits at a lunch counter to order a cup of coffee. And, like many of his colleagues, Ed sometimes grows impatient and often annoyed when he's served coffee that is one, too weak; two, full of the bitterness that goes with a serving temperature that's too hot; three, stale. And, just as his colleagues in the gas business elsewhere, he never blames the waitress.

But unlike his colleagues, Mulcahy did something about the problem. He observed the many paces and time-wasting efforts the waitress had to go through to brew a pot of coffee. He figured 15 minutes of her time per batch of coffee could be saved if restaurant coffee making was made automatic.

Result: Ed Mulcahy has come up with an answer. Developing a unique, time-saving, automatic gas coffee maker, he may have performed a genuine service for his industry. What's more, he may have invented a boon to restaurant operators. His coffee maker, completely automatic, provides a foolproof method for making rich, flavorful coffee — using the accepted glass container method (the water is forced through the coffee in a container above and then is returned to the glass container after being brewed).

Ed's coffee maker does the following:

It materially cuts the time of brewing coffee with similar methods. Coffee made in this manner can be done in

The old, tedious electric method . . .

1 In electrical coffee making process Oklahoma Natural employee Sandra Sue Dufford first places water on the stove. She turns on the current to "high."

2 After waiting 15 minutes for water to boil, Sue lifts coffee maker off electrical element to avoid excessive boiling which lingering heat from element would cause. She places top on, dumps in coffee and replaces coffee maker on the burner.

1 In the new completely automatic, one-step gas method, all operations are combined at one time. Thermostatic controls on gas stove bring water to a boil and brews the coffee.

2 Only minutes later happy Sandra Sue returns to the stove and is ready to pour a cup of hot, flavorful coffee.

one-third the time.

And, **the saving in labor is really remarkable** when compared to an electric coffee maker of this type.

Heat-up time is reduced.

Switching of coffee on and off units is eliminated and the customer gets a good cup of coffee that is not overheated after brewing.

In his fully automatic coffee making process, Ed merely sets the coffee pot on the thermostatically controlled gas burner and pushes a button. The rest is automatic.

First of all, the flame ignites and the water is heated to a predetermined temperature.

Next, the boiling water rises to the top of the coffee maker, agitates the coffee grounds and, as it cools, flows back into the glass container below.

When the water is in the top container, the gas burner automatically cuts off to a keep warm flame. This allows the coffee to automatically syphon back without equipment being removed from the burner. The burner will maintain the coffee at a delicious serving temperature between 170-180 degrees.

The waitress has only to set the pot on the burner, flip the control, and leave the rest to the automatic coffee maker. Minutes later, the coffee has been automatically brewed and is ready to serve.

Mulcahy's coffee maker will be displayed at the American Gas Association Convention in Atlantic City. The working model will be made available to manufacturers of coffee makers for their information and application. * *

3 After water rises to the top, Sue again lifts coffee maker off the hot element and stirs it.

4 Still another step in making coffee electrically — Sue returns coffee to "low" for serving. But it takes nearly half an hour for the coffee to cool to serving temperatures.

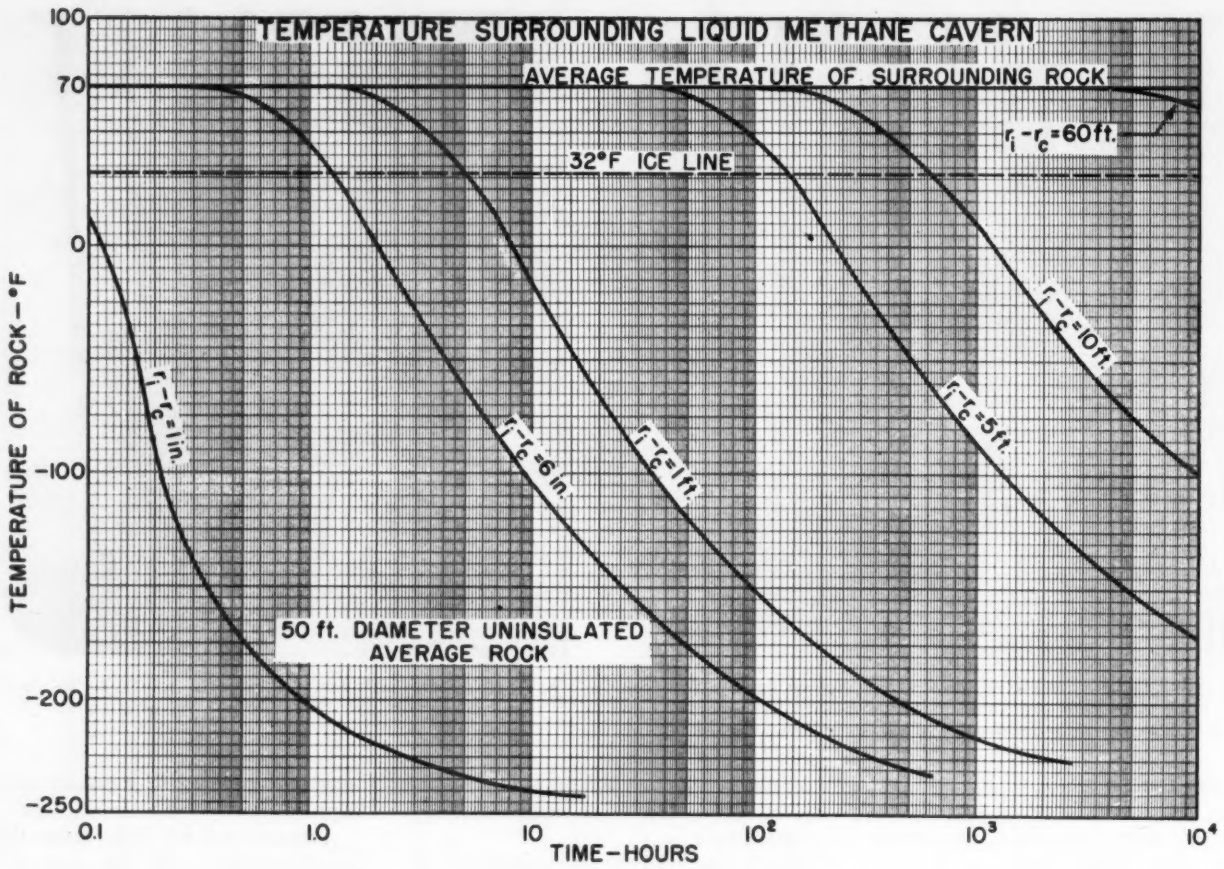


Fig. 1. Temperature surrounding liquid-methane cavern.

How Feasible Is Underground Storage of Liquefied Methane?

Donald A. Flanagan* *and* **Paul B. Crawford****

Texas Petroleum Research Committee
A. and M. Division, College Station, Texas

Abstract. A study has been made of the feasibility of storing liquid methane at low pressures in underground caverns. Methane liquefies at −258 F at atmospheric pressure. It is shown that the methane evaporation rates will rapidly decrease and cool the surrounding rock so that at the end of one month they would be between 50 Mcf per hr for a cavern of 25-ft radius and 700 Mcf per hr for a cavern of 100-ft radius. At the end of 10 years, the evaporation rates would be 18 and 100 Mcf per hr, respectively, for caverns of the same radii. The evaporation rates may be reduced by a factor of 2 to 10 by the application of insulation.

The cost for mining the caverns is estimated to be $0.75 to $1.25 per Mcf of storage. This is substantially less than surface storage; it is believed to be safer and to result in lower maintenance, savings in space and savings in strategic materials.

ECONOMIC FEASIBILITY OF LIQUEFIED METHANE for the gas distribution industry is being studied today in many quarters. Methane in liquid form is being transported by tanker. Methane liquefaction is also being reconsidered for shaving peak gas demands. Numerous articles *(See AGJ May 1960, pp 23-30)* have described natural gas liquefaction and the progress of the tanker in making trial runs from the United States to Great Britain to determine the feasibility of tanker transport.

At the present time, pipelines are not able to supply peak gas loads during extremely cold periods such as are often encountered in the North and Northeast. Gas is stored in underground reservoirs enroute to its destination, but in many instances satisfactory storage in porous reservoirs has not been practical, especially along the Eastern seaboard

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where few petroleum reservoirs have been found. In England and other foreign countries, it is unlikely that satisfactory porous structures could be found, and it may be desirable to mine or excavate the rock to obtain storage. By storing the methane near the consumption point, product availability can be increased during periods of need.

Methane liquefies at −258 F at atmospheric pressure, and 1 cu ft of liquid methane will make about 600 cu ft of gaseous methane. Methane liquefaction for shaving peak gas demands was conducted in Cleveland, Ohio in the early 1940's. The Cleveland plant was designed to liquefy 4 MMcf per day of natural gas.

Development of several low-temperature processes has resulted in some improvements in the design of low-temperature storage vessels. Liquefied-methane storage vessels can be designed for various evaporation rates. The desired rate will depend on the reason for liquefaction.

For shaving peak gas demands, the desired evaporation rates would be low, possibly between 0.2 and 1.5% per day. For methane tanker transport and supply, the evaporation rates must be high and must equal the total daily rate of supply.

It is apparent that the cost of storage facilities will depend on the objective and will vary appreciably. Surface storage of methane may cost between $3000 and $20,000 per MMscf, depending on the size and design. The failure of the surface vessels at Cleveland, with the resulting injury and loss of many lives, has caused considerable emphasis to be placed upon developing new, safer and improved methods of storing liquid methane.

Underground Storage

Storage of liquefied propane and butane in underground salt domes has been very satisfactory. The per-barrel cost of underground storage for any sizeable capacity is very small compared to the cost of surface storage for LPG mixtures. The larger the capacity of the underground storage, the less is the per-barrel cost. Numerous advantages appear to exist if liquefied methane could be satisfactorily stored underground, the principal advantages being increased safety, lower initial cost, lower maintenance cost, savings in space and savings in strategic materials.

In view of the operational hazards experienced in storing liquid methane above ground, it appears necessary to consider alternate storage methods that may be safer and perhaps more desirable for successful commercial liquefaction of methane for its several applications. In the application where liquid methane is transported by tanker for large-scale users, it would appear that an un-insulated cavern would be suitable.

For this application, little commercial use can be made of the low-temperature refrigeration in the first deliveries; therefore, the first few months of operation may be utilized to cool the cavern. After the passage of a few months, presumably, an outlet for the potential power generation from methane evaporation would be established. At this time, the natural methane evaporation rate from the cavern would be small and would permit almost all of the methane to be used for power generation.

When methane is to be liquefied to shave peak gas demands, some form of insulation probably will be desired. It still may be much safer and more desirable to mine a cavern and store the methane in insulated tanks inside the cavern than to use above-ground storage. Through utilization of this technique, the daily natural evaporation rate could be reduced quite easily to a fraction of a percent of the methane stored; the operational hazards would be minimized.

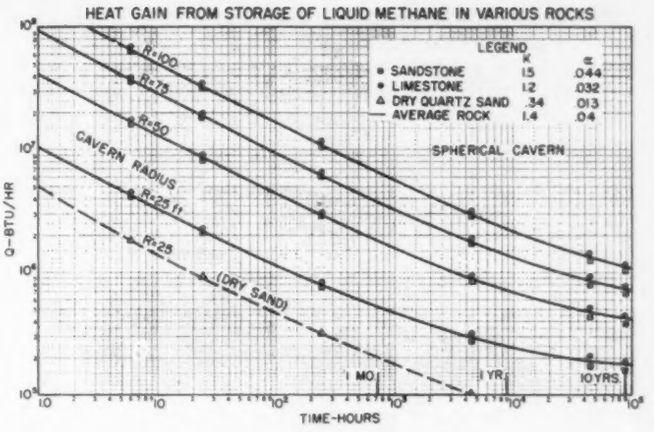


Fig. 2. Heat gain from storage of liquid methane in various rocks.

Feasibility

Underground storage of liquid methane appears feasible for various types of rock. Storage costs appear to be much less than above-ground storage; less maintenance and materials are required, and the technique is believed to be considerably safer. Possibilities of using salt caverns for storage are also indicated.

Purpose of this article is to determine the feasibility of storing liquid methane underground in mined caverns.

If a large spherical cavern is dug underground and is filled instantaneously with liquid methane, the surface of the sphere may approach the liquid methane temperature almost instantaneously. The temperature distribution for a sphere of radius r_c in an infinite medium, initially at one

The Authors

Dr. Paul B. Crawford received his BS degree in chemical engineering from Texas Technological College in 1943. He was employed by American Cyanamid and Chemical Corporation and worked on the development of synthetic fluid cracking catalysts. He returned to graduate school and received his MS and PhD in chemical engineering from the University of Texas.

Dr. P. B. Crawford

D. A. Flanagan

In 1947 he was employed by Magnolia Petroleum Company, field research laboratories, and worked primarily on the underground combustion recovery process, a method whereby oil is produced by the creation and propagation of a burning zone within the oil-bearing rock. He is the inventor of several innovations of the process.

In 1952 he was employed as assistant director of the Texas Petroleum Research Committee at Texas Agricultural and Mechanical College of Texas Division and is a member of the Graduate Faculty. He is the author of more than 50 publications on petroleum production.

He is listed in *Who's Who in Engineering, Who's Who in the South and Southwest, American Men of Science* and is a consulting engineer.

Donald A. Flanagan is a graduate of Texas A&M College. He was formerly a research technologist associated with the Texas Petroleum Research Committee, College Station Branch. After graduation from A&M he was employed by Russell Engineering of Abilene, Texas. He is now associated with Fred L. Oliver and Associates, Dallas, Texas.

temperature with spherical surface kept at T from time t = 0, is given by Eq. 1:

$$\Delta T = \frac{T_d r_c}{r_i}\left\{1 - \phi[(r_i - r_c)\eta]\right\} \text{ for } r_i \geq r_c \quad . \quad (1)$$

Where $\phi[x] = \text{erf}[x] =$ probability integral or

$$\text{error function} = \frac{2}{\sqrt{\pi}}\int_0^x e^{-\beta^2}\, d\beta$$

$$\text{and } \eta = \frac{1}{2\sqrt{\alpha t}}$$

Note the form Eq. 1 takes when the error co-function is used.

$$\Delta T = \frac{r_c T_d}{r_i}\,\text{erfc}\,\frac{(r_i - r_c)}{2\sqrt{\alpha\, t}} \quad . \quad . \quad . \quad . \quad (2)$$

By evaluating the $\partial T/\partial r$, the heat flux into the medium at $r_i = r_c = R$ (the cavern radius) has been shown to be

$$q = 4\pi k R T_d\left[1 + \frac{R}{\sqrt{\pi\alpha t}}\right] \quad . \quad . \quad . \quad (3)$$

Numerical solutions to Equations 1 and 3 have been made for a large range of variables. In reviewing the equations, it will be found that both the temperature distribution and heat flux vary with the thermal properties of the rock, cavern radius and time. Pertinent rock properties include the thermal conductivity, density, heat capacity and the thermal diffusivity. Some of the various rock thermal properties are shown in Table 1.

TABLE 1. Thermal Properties of Various Materials

Material	Thermal Properties			
	k	c	ρ	α
Granite	1.6	0.19	168	0.050
Limestone	1.2	0.22	168	0.032
Marble	1.3	0.21	168	0.037
Sandstone	1.5	0.21	162	0.044
Average Rock	1.4	0.21	165	0.04
Calcareous Earth, 43 Percent Water	0.41	0.53	104	0.007
Quartz Sand, Medium Fine, Dry	0.15	0.19	103	0.008

Fig. 1 presents a series of curves showing the temperatures surrounding a liquid-methane cavern for a specific condition. The cavern was assumed to have a diameter of 50 ft; it was un-insulated and mined in average rock. From Fig. 2 it is noted that, at the end of one hour, the temperature of the rock 1 inch from the liquid methane-rock interface would have cooled to approximately −200 F; 6 in. out, the temperature would be only about 40 F. This sharp difference in temperature, which exists over a 5-in. interval, shows the very significant thermal-insulation properties of rock.

At the end of approximately 50 hours, the temperature 5 ft into the rock from the liquid methane still would be approximately 70 F and would only cool to approximately −100 F after the lapse of more than 30 days. These very sharp temperature gradients indicate very clearly the ability of earth to serve as a fairly good thermal insulator. The outward movement of the 32 F temperature, or ice point, is readily seen.

Fig. 2 shows heat gain from storage in several types of rock for several cavern radii as a function of time. The inset to the figure shows the thermal properties of the various types of rock. Note that the thermal conductivities for dry quartz sand, limestone, sandstone and average rock are indicated to be 0.34, 1.2, 1.5 and 1.4, respectively. The thermal diffusivities differ by a factor of four, as shown by the inset.

After calculating the heat flux for the various rock types, it was found that the heat fluxes from the sandstone, limestone and average rock were substantially the same. The slight differences obtained are indicated by the spread in the data points on Fig. 2. Dry quartz sand is an unusually good insulation material and is included for information purposes.

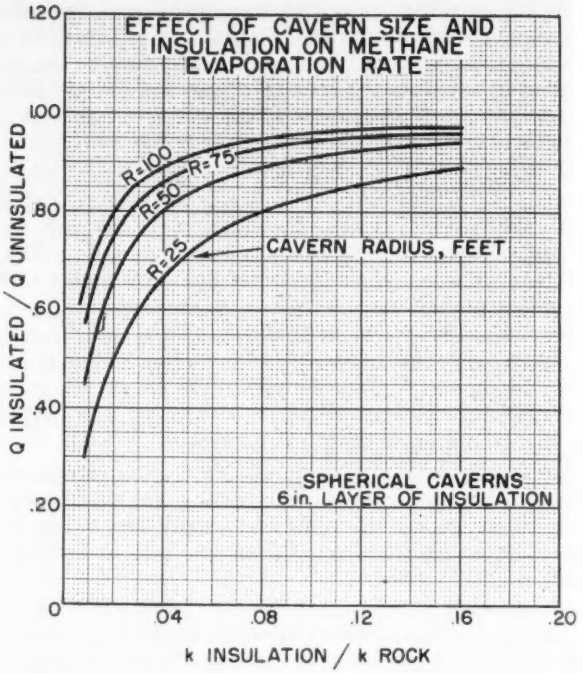


Fig. 3. Effect of cavern size and insulation of methane evaporation rate.

From Fig. 2 it will be seen that, at the end of 10 hours, the heat flux into the cavern would be from 3 to 50 million Btu per hour for cavern radii of 25 to 100 ft. However, at the end of four days, the heat flux would have decreased to one million and 16 million Btu per hour for cavern radii of 25 and 100 ft, respectively. At the end of one year, the heat flux will be between 250,000 and 2 million Btu per hour; at the end of 10 years, the heat flux will be between 180,000 and 1 million Btu per hour for cavern radii of 25 and 100 ft, respectively.

From a study of the thermal properties of methane, it will be found that, for storage near atmospheric pressure, approximately 10 Btu will be required to evaporate 1 scf of methane. If the Y axis in Fig. 2 is divided by 10, the evaporation rates can then be read as cubic feet of gas evaporated per hour. At the end of one month, for example, the evaporation rates would vary from 50 to 700 Mcf per hr for caverns of 25 and 100 ft radii, respectively. At the end of 10 years, the evaporation rates would be from 18 to 100 Mcf per hr.

Insulation

The previous discussion has concerned the storage of methane in direct contact with the containing rock. A reduction in heat flux and evaporation rate can be obtained by insulating the walls of the cavern. The ratio of the heat flux of an insulated cavern to the heat flux of an un-insulated cavern is shown in Fig. 3. The ratio of the thermal conductivity of the insulation to the thermal conductivity of the rock is a measure of the effectiveness of the insulation.

The use of a 6-in. layer of insulation could reduce the evaporation rate by a factor of 2 to 10 for the small caverns. Fig. 4 shows the ratio of the heat flux for the insulated cavern to the heat flux of the un-insulated cavern as a function of the thickness of insulation ($R_1 - R_2$). These calcu-

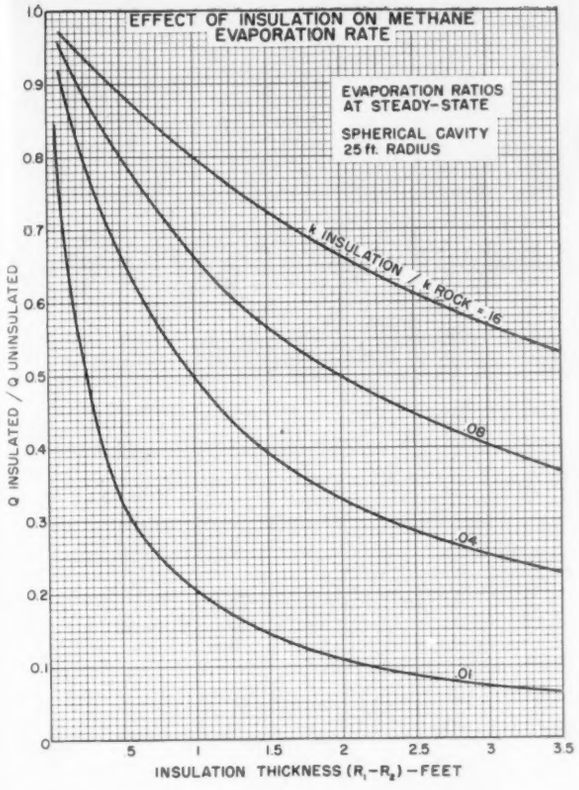


Fig. 4. Effect of insulation on methane evaporation rate.

lations concerning the effectiveness of insulation were made assuming steady-state heat transfer.

The calculations shown in this article have been made with the assumption that the methane would be stored at atmospheric pressure in the earth, and the earth was originally at 70 F. If the methane were to be stored at some elevated pressure, the liquefaction or storage temperature would be higher, resulting in a lower heat flux from the earth to the methane.

Storage Shapes

From the standpoint of storage with minimum heat loss, it is quite likely that the ideal storage shape would be spherical in nature; however, many factors must be considered in preparing the excavations, and there are many things which prevent one from achieving the ideal shape. The strength of the rock should be moderate, and the bed should be very thick.

The usual stratified nature of rock, together with its variable strength, would result in the possibility that the chambers themselves will be modified circles or a rectangular cross-section. In any event, it is believed that a very detailed study must be made of the site, including substantial coring and a study of the nature of the overburden and bed rock. Insofar as mining costs go, it usually costs less to excavate a large chamber than to obtain the equivalent volume in many small openings.

Costs

On the basis of data initially developed for LPG storage, costs for mining storage caverns at depths ranging from 300 to 500 ft could range from $4.00 to approximately $2.50 per bbl for storage volumes of 100,000 and 500,000 bbl, respectively. This is equivalent to about $.75 to $1.25 per Mcf for storage. It should be noted that these costs are substantially less than above ground storage. In addition to the reduced cost, there is also a reduction in the metal requirement if underground storage is used.

It is believed that contamination would be very small. The temperature distribution surrounding the storage volume is such that the freezing point of 32 F would be found at an increasing distance from the storage cavity. Consequently, if water were to migrate towards the sphere, it would freeze at a great distance from the cavity itself. Since the temperature of liquid methane is substantially below the solidification temperature of CO_2, H_2S and NH_3 (all solidify at near −120 F), these other gases would also solidify before reaching the storage cavern.

The possibility of storing liquid methane in underground caverns, as a supplement to above-ground storage and underground gaseous storage in porous strata, increases considerably the areas and provinces that can be more effectively served with natural gas.

The northern portion of the Atlantic seaboard, from New Jersey to the Carolinas, consists mostly of a coastal plain that seems to be suited for mining of shale cavities. The southern portion of the Atlantic seaboard in Georgia and Florida consists of sand and limestones at shallow depths. The Appalachian core, from Maine south into Georgia and eastern Alabama, provides possibilities of storage in granite or hard rock.

West of the Appalachian core is the folded belt of sedimentary rocks that, in addition to providing natural reservoirs for storage, may offer possibilities for mining liquid methane reservoirs in shale or limestone. In the central region, a large area of shale exists which may be favorable for mined storage. The Rocky Mountain area, extending from Montana into New Mexico, offers possibilities for hard-rock mining for storage purposes. In the Pacific Coast area, west of the Sierra Nevadas in the Cascade ranges, there are shale strata which could be mined for liquid storage of methane.

The previous discussion has been developed in terms of storing liquid methane in rock. By use of the general charts, one may also develop similar specific charts for storage in salt. Bedded rock salt occurs in the Great Lakes district, in the Northern Appalachian geosyncline, in the Michigan basin underlying parts of New York, Pennsylvania, West Virginia, Ohio, and Michigan, and in a large area of the South Central states known as the Permian Basin, which underlies parts of Kansas, Oklahoma, Texas and New Mexico. Salt domes on the Gulf Coast, from the Mexican border to Alabama, also might provide possible storage sites.

Nomenclature

α = thermal diffusivity, $\frac{k}{\rho c}$ sq ft/hr
c = specific heat, Btu/lb F
k = thermal conductivity, $\frac{\text{Btu}}{\text{hr sq ft } ^\circ\text{F/ft}}$
Q = heat flux, Btu/hr
ρ = density, lb/cu ft
r, R = radius, subscript i refers to radius of interest, subscript c refers to cavern radius, ft
t = time, hours
T = temperature, F
T_d = temperature difference = normal earth temperature minus cavern temperature, F

Acknowledgment

This article was adapted from a paper presented at the Joint TPRC-SPE Oil Recovery Symposium on Southwest Texas, 1959, Corpus Christi, Texas, and published in the June 1960 issue of *Journal of Petroleum Technology*. ★ ★

Home safe — guided by gas lights.

Toronto's Goodwood Airport Goes All-Gas

R. M. Shaw, *Consumers Gas Company, Toronto, Canada*

Viewed from the rear seat of a 4-seater, 172 Cessna, at a couple of thousand feet altitude, the sprawling gas-lit triangle of Goodwood Airport is a pleasant sight. The 250-acre airport — second in size only to that of Toronto's Malton Airport and nestling among green fields 30 miles from downtown Toronto — is Canada's first completely gas-equipped airport.

Believed to be the first airport anywhere to have three separate runways individually controlled and gas-lit, the Goodwood, Ontario, field boasts 2600 and 3000-ft runways and a 600-ft taxi strip. Natural gas is used in the airport restaurant for cooking and water-heating. Hangars and workshops are also gas heated.

Operators of this largest private airport in Southern Ontario cite main advantages of gas lights for airport lighting as reduced glare, lower installation and operating costs, and a minimum of equipment servicing.

Joe Koblinsky, owner of the field and a well-known Toronto builder, decided to go to gas lights after a visit last year at Little Rock, Arkansas, where he and Bill McKeown, Consumers' Gas Company's north central area sales supervisor inspected a similar airfield utilizing gas lights. *(See AGJ May, 1959)*

Examining the gas light used to illuminate Canada's first gas-lit airport are three Consumers' north central district men—left to right—W. Whittingstall, service supervisor, W. McKeown, sales supervisor, and W. Heaton area manager.

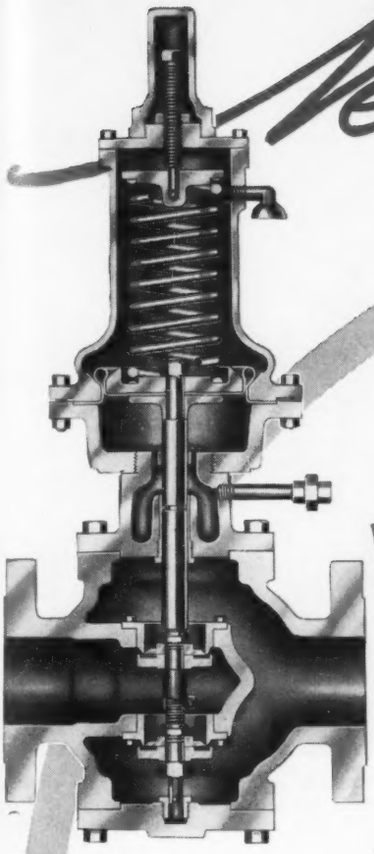
Impressed with the U. S. project, Koblinsky asked Consumers' to install natural gas lighting at Goodwood. Complete installation of lights, metering, and all controls was designed by Bill Whittingstall, service supervisor, north central area, and installed by Consumers' service department under his supervision.

Gas lights used at Goodwood are

Automatic — Frank Warr, Consumers' fitter, points to three photoelectric cells that automatically modulate the brilliance of the gas lights on the two runways and taxi strip.

Or manual control — Switches allow runway and taxi strip lights to be operated manually should weather conditions interfere with the photoelectric cell control.

New in principle!



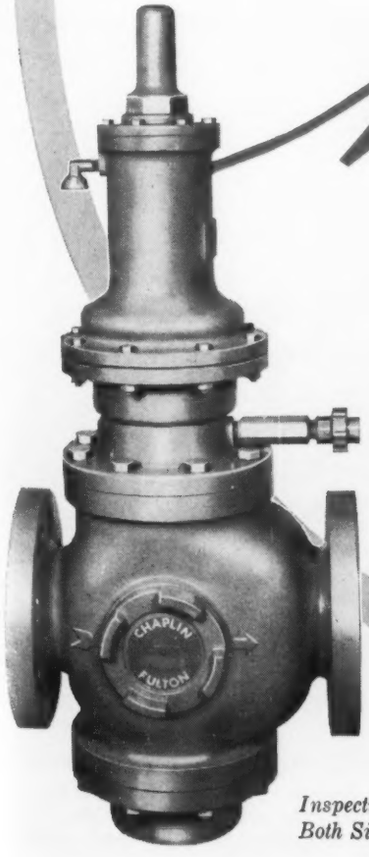
CHAPLIN-FULTON

MODEL 441-57S GAS REGULATOR

SIZE: 2"—3"—4"—6"
125 lb. iron—W. P. 175 psi
250 lb. ductile—W. P. 400 psi
Series 30 steel—W. P. 720 psi

Model 57-S, a simple spring loaded regulator, operates on a new diaphragm principle which will control accurately until the regulator is wide open. The outlet pressure "fall-off," typical of spring regulators, is eliminated—not by an uncontrolled velocity effect—but by a diaphragm which changes its size as the valve moves to give straight line control. For pounds-to-pounds service,—controlled pressures to 75 psi with same assembly.

New in design!



Inspection Plates Both Sides.

Also, a new body design—441—with gas exit areas greatly enlarged to prevent turbulence and increase capacity.
And to help in your visual inspection program—side inspection plates on *both* sides of the body have been included. Screwed-on with O-ring seal, they can be quickly removed and replaced—no gasket problem. Standard face-to-face dimensions now make the 441 interchangeable with other regulators.

ACCURATE CF MFG CO. DEPENDABLE

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Pittsburgh 25, Pennsylvania

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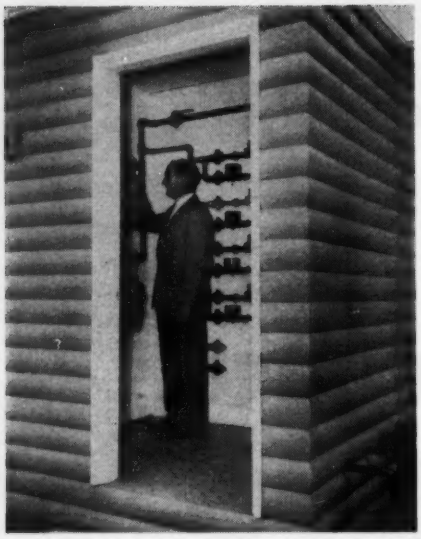


Controls and metering equipment are housed in a special well-ventilated room. W. Whittingstall, Consumers service supervisor, who designed installation of lights, metering, and all controls, checks the equipment.

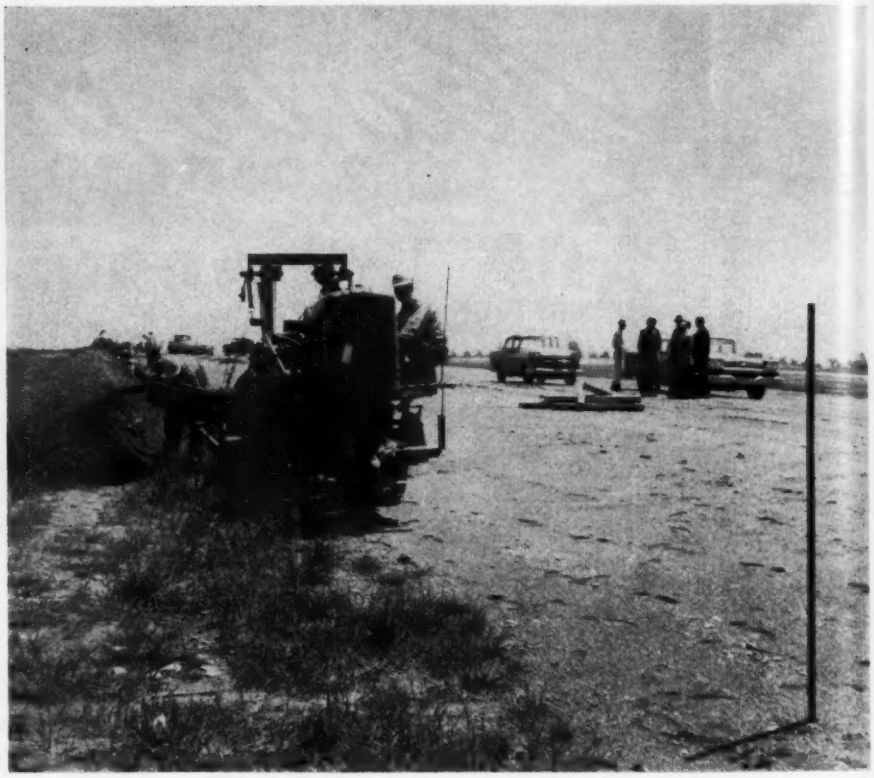
modifications of the "Doorman" model minus the wall mounting bracket, manufactured by Arkla Air Conditioning Corp., a wholly-owned subsidiary of Arkansas Louisiana Gas Co. Each light is individually regulated and all are independent of each other. Biggest light operates on 1.9 cu ft per hour; smallest light uses 0.30 cu ft per hour. Illumination, at top brilliance, is 40 to 45 candlepower. Mantles on the 94 lights have an estimated life of 9 months and burn 24 hours a day.

Since the lights burn continuously, a photocell mechanism has been designed to modulate their brilliance. During daylight hours, with the cell closed, there is an almost imperceptible glow, but as afternoon stretches into evening the cell adjusts until at nightfall the flame is at full brilliancy. **In operation, the present runway lighting equipment will use about 4000 cu ft of gas a day.**

Officials of the Canadian Department of Transport gave their approval for night flying operations and stated that they were favorably impressed with the gas lighting.

Controls and metering equipment for the two runways and taxi strip are housed in a special well-ventilated operating room attached to the main airport building. Three photocells located above the door to this room, operate the relay and solenoid valves which determine the flow of gas to the runway lights through three main supply lines. A fourth feeder line for driveway lights, will be switch operated. Additional connections provide for future runway expansion.

For quick identification, the four supply line systems — runways, taxi strip and driveway — are color coded. A chart clarifies the color to all



Trenching machines made laying of the line a fast, efficient job. By lining up pole in the ground (right) with rod on front of tractor, operator is able to dig perfectly straight ditch.

Stringing the pipe. Because of weather extremes in Southern Ontario, the gas supply mains were laid at a depth of three feet, and special frost protectors installed on each of the 94 lights.

All welds in the line are checked closely with radiography unit of Consumers' Gas Company. Radiographer Len Green, left, takes "picture" of weld with "gamma camera."

Gas lights are modifications of Arkla's "Doorman" model minus the wall mounting bracket. Each of the lights are set in special bright yellow cones along the edge of the runways.

personnel responsible for airport operations.

The manually-set fine adjustment, which controls the flame of all lights on a particular system is fitted to red-painted by-passes on each feedline.

Because of temperature extremes, lines at Goodwood were laid at a depth of 3 feet and connected to the surface lights by heavy duty copper tubing. Further protection is afforded by a 2-in. frost protector that extends from ground level to the main at each light location. In addition, the lights — all 94 — are set at 200-foot intervals in special galvanized cones, painted bright yellow, along the edge of the runways above ground level.

As well as automatic or photocell control, the installation is capable of manual control. The photocell can be shut off by a master switch in the flight office if, because of weather or other conditions, flying is discontinued.

Plans are under way now for extension of two runways at Goodwood, one from 2600 ft to 2800 ft, and the other from 3000 ft to 3400 ft. Other plans include a gas-lit paved driveway, 600-ft taxi strip, and larger hangar space. When completed, later this year, the paved approach driveway will be lit by 24 ten-foot high "Flair" model gas light standards.

Information gleaned from the visit to Arkansas and further communications with John Hartsfield, superintendent of distribution of the Arkansas division of Arkansas-Louisiana Gas Company, helped to get the Goodwood project under way and reflects the spirit of cooperation that exists between gas utilities in North America. * * *

Bud **Martin,** construction foreman for Consumers', discusses plans for the installation with Elmer Osbourne, foreman of the contractor, R. B. Somerville Construction Co.

Impressive. Entrance to the Gas Appliance Center is imaginative, modern, strikingly colorful. Animated flame display in center highlights industry exhibit area. At left foreground is reception desk; at right, modern gas kitchen; individual showrooms are on either side of corridor in background.

SUCCESS STORY:

Gas Appliance Center Spurs Industry Cooperation

Dean Hale, *Editor*

The only year-around, permanent display of its kind in the nation.

"It's unique," said the visitor from New York, taking notes on how the Gas Appliance Center operates. We think we can make this idea work in putting together an international trade center in New York City," he added, paying the Center a terrific compliment by noting that "no other industry of any kind has anything like this."

To the 26 exhibitors in the Gas Appliance Center, strategically located in Dallas' fabulous Trade Mart, in the heart of a burgeoning, busy multi-million dollar Master Market Center, the GAC is more than a showcase for their products . . . and for the gas industry . . . it is a sound business venture.

In the short time the GAC has been in operation, results of its power to attract buyers is conclusive evidence that the idea is sound. Growing numbers of dealers, builders, utility sales personnel, and other buyers are finding their way to the Center. A lot of orders have been placed. Exhibitors have expressed their confidence by establishing permanent sales offices in their showrooms. Some have expanded their showroom space.

Yet the Gas Appliance Center is even more than just a place to show appliances and take orders.

It is helping stimulate an uplifted attitude toward gas appliances in particular and the gas industry in general.

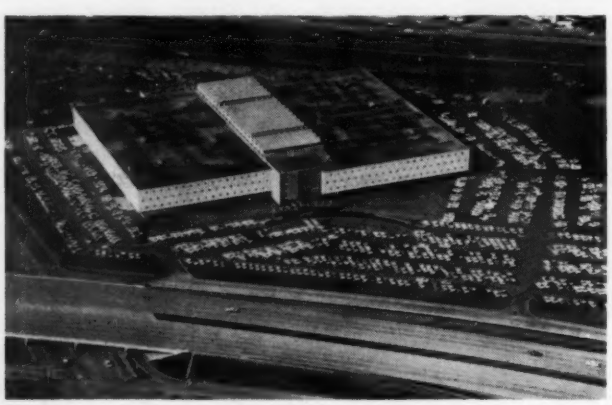
"The glamorous Trade Mart is an appropriate setting for displaying bright new gas appliances and telling our industry story," declares David J. Kerr, president of the group of Dallas businessmen and gas industry executives who have built the Center literally "from scratch."

Dave Kerr glows enthusiastically as he describes the Center's activities. "We've developed a feeling of pride and excitement, both among those directly associated with the gas industry and those whom we are endeavoring to influence."

Manufacturers' representatives working out of the GAC echo his words with their enthusiasm . . . gas company employees who visit the facilities show keen interest in the Center and are counted among its avid boosters.

In less than a year's time, the Center has grown from an idea to reality, proving that the gas industry can, through cooperative effort, put its best foot forward. It was conceived in the gas industry, backed by the industry's manufacturers, and is operated for the industry's benefit.

Why a Gas Appliance Center in Dallas . . . instead of New York or Chicago or some other area? The need for a unified, industry-backed "showcase" had long been felt. But words were always more abundant than actions. It took a small band of determined Texans . . . all interested in the gas industry's future . . . to get the wheels moving

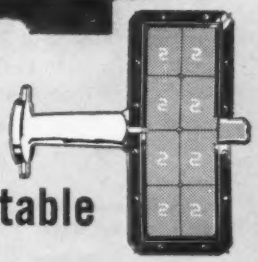


Gigantic. Dallas Trade Mart is biggest of market center units; 4-story building has 1-million sq ft, cost $18-million. Other units include Homefurnishings Mart, Market Hall, 600-room luxury motel. Due in 1962 — Construction Materials Mart with multi-story office building.

HARDWICK AUTOMATIC
GAS RANGES

Famous MicroRay *Range*

. . . with the fabulous new ceramic burner that cooks twice as fast with half the gas. Introduces an entirely new and exciting concept of cooking.



. . . most versatile, profitable line in the industry

From the top-of-the-line MicroRay to America's most popular priced models, Hardwick presents its 1961 line – designed and priced to sell 8 out of 10 of your prospective customers.

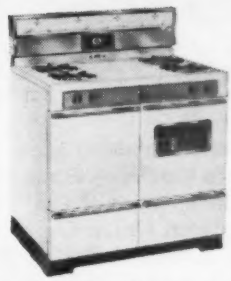
. . . and no matter what you pay you can't buy better cooking performance!

ADVERTISED IN **McCall's, Ladies Home Journal, Better Homes & Gardens, House Beautiful, American Home, Living for Young Homemakers, Family Circle, Woman's Day and Parents.**

HARDWICK STOVE COMPANY
CLEVELAND, TENNESSEE

Gold Star Award
A. G. A. Approved Deluxe Ranges Built to Gold Star Standards.

USE-TESTED BY McCall's



Standard Size 36" Model—All new luxury styling to please the modern homemaker of today.

Space-Saving 30" Model—A brand new space-saving beauty that will add charm to any kitchen.

Compact 20" Apartment Model—Beauty and efficiency in even the smallest of Hardwick Ranges.

The All New Built-Ins with bold, Futurama design . . . smart fashion colors in six choices to blend with any kitchen decor.

Showcase of the Gas Industry. All showrooms open to central corridor, feature full glass fronts, indirect lighting, attractive decor. The "all-in-one-location" gas appliance merchandising idea is especially pleasing to dealers, distributors, builders, architects, other buyers . . . gives them opportunity to compare, pick and choose, buy, and familiarize themselves with "what's new" in gas appliance lines.

Idea for establishing a gas industry showcase in the Dallas Trade Mart took form in the summer of 1959. To Dave Kerr, Southern Union Gas Company's executive assistant, the magnificent Trade Mart seemed an ideal setting for "putting the gas industry on a pedestal."

Kerr immediately enlisted aid. It came from Charles Barndt, director of sales promotion for Lone Star Gas Company; Ray Cooper and Wik Wikstrom of American Gas Association; Bob Suttle, managing director of the Southern Gas Association; and Joe Woods, publisher of American Gas Journal. First and foremost in their thinking was to perform a needed service for the industry.

Presented initially to a small group of manufacturers, the concept of a "Gas Appliance Center" received unanimous approval.

Armed with this response, and facts and figures on what could be done, the group took its plans to the A.G.A. convention in Chicago in October 1959. Formal discussions with some 25 manufacturers produced enthusiastic response. Returning to Dallas, the group organized a private company, known as Gas Industry Exhibitors, Inc., to operate the new Gas Appliance Center.

Plans were laid for a January 1960 formal opening. Initially, some 20 manufacturers agreed to take space in the Center. Working at an almost feverish pace throughout November, December, and early January, the group transformed 25,000 sq ft of unfinished Trade Mart space into a sparkling new "Showcase of the Gas Industry."

On January 16, 1960, the Center was formally dedicated.

The doors had barely opened when the first swarm of buyers hit like hungry grasshoppers in a Kansas wheat field. The occasion was the annual Southwest Homefurnishings and Furniture Market slated for January 18 through 22 . . . with more than 10,000 buyers visiting the Trade Mart. Business began with a "bang."

First sale at the Gas Appliance Center was rung up at 7:55 a.m. on January 18 . . . the first real "day of business" for the 22 manufacturers exhibiting . . . and the string of sales has since continued. In the following months, nine other "markets" or "Market Days" have been held, each attracting important buying groups.

The Center's staff has been busy with a constant stream of other groups. Importance of Dallas as a convention center was highlighted during the annual Southwest Heating and Air Conditioning Exposition, which supplied many interested visitors to the Center. A.G.A.'s Public Information Committee visited the center and used Trade Mart facilities for its meeting. So did the A.G.A. General Promotion and Planning Committee for its semi-annual national meeting.

Area gas utilities make good use of the Center. Thirty some economists spent a full day at the Center as part of an annual training program sponsored by Lone Star Gas Company. Both Lone Star and Southern Union Gas send groups of their employees to the center for tours and briefing on the newest in gas appliances. Employees of the two gas utilities in the Dallas-Fort Worth area have been feted with an "employees open house."

Utility groups—executives, sales per-

Simplicity of taking apart a modern gas built-in oven for cleaning is demonstrated to potential buyers in town for Mart's "market days."

General exhibit area attracts large crowds. Visitors here look over new gas air conditioning unit on display.

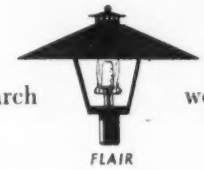
Gaslites are now a part of the American Scene

being a parent in the re-birth of the gas light industry lays

a pretty heavy responsibility in our lap: establishing and maintaining the quality standards

of this husky young giant.

Through research

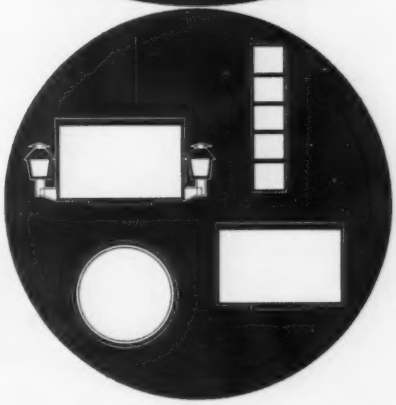


we've endowed our child with quality and styling

that has made him become again a part of the

American scene, and made him tops in sales and prestige.

maybe you'd like to meet another of our children — Gasigns by Arkla. Same family characteristics.

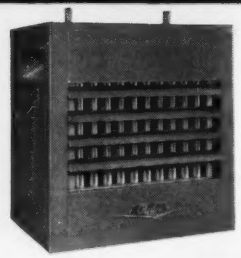


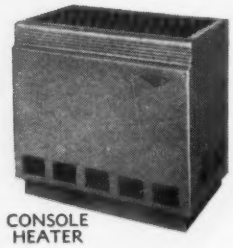
Arkla Air Conditioning Corporation • Shannon Bldg.
Little Rock, Arkansas

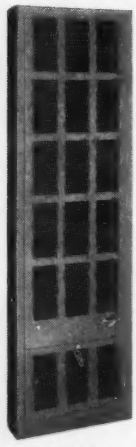
Always
on Display

Peerless®
GAS HEATING EQUIPMENT
DURA-VENT
GAS VENT SYSTEMS

Room
2842
Gas
Appliance
Center
DALLAS
TRADE
MART


UNIT HEATER


CONSOLE HEATER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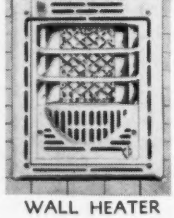
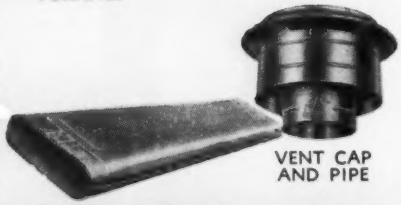

WALL HEATER

at the A. G. A.
CONVENTION

visit Peerless
AND
DURA-VENT
DENNIS HOTEL
ATLANTIC CITY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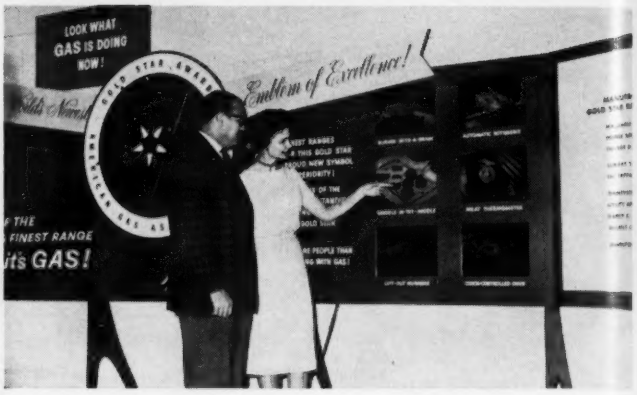
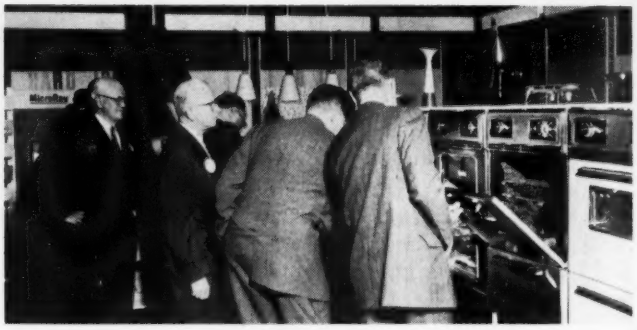
AND PIPE

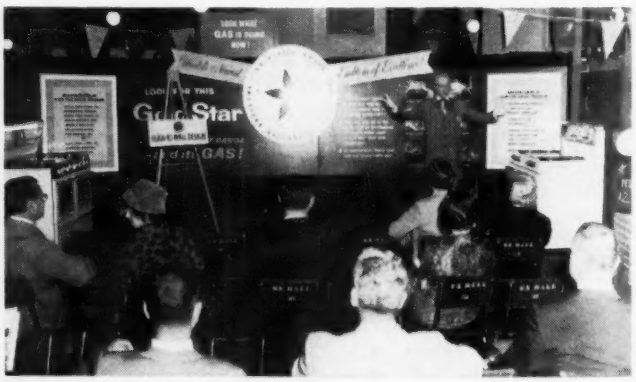
DOVER CORPORATION
DOVER Peerless MANUFACTURING DIVISION
1400 W. ORMSBY AVE. - P. O. BOX 2015 - LOUISVILLE 1, KY



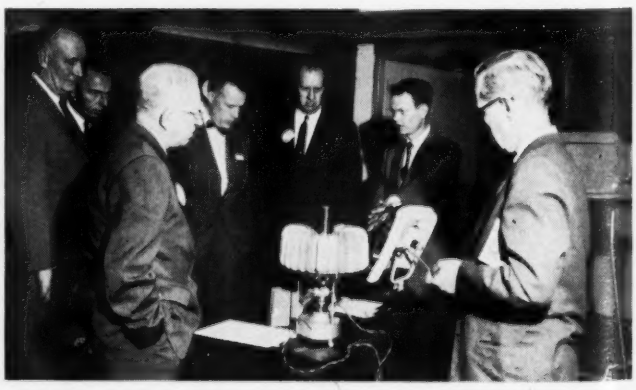
Gold Star Range display in industry exhibit area carries message to buyers. A.G.A. field representative Ray Cooper and GAC receptionist-secretary Loyce Campbell discuss display.



Close-up look at modern built-in gas units is taken by members of A.G.A. General Promotional Planning Committee during recent meeting of the industry group at the Gas Appliance Center.



School for Gold Star Salesmen. Mechanical man demonstration of Gold Star Ranges was held in Trade Mart exhibition hall.



Futuristic. Research developments, such as the Catalor flameless heater (right) and a thermoelectric generator, both gas-fueled, are displayed in GAC's industry exhibit area.

Winners. Dallas County homebuilder team of Mr. and Mrs. Richard F. Mellen receives tickets for trip to Mexico from Tom Fisher, right, manager of the Gas Appliance Center. The couple won the trip at "Homebuilders Night" at the Gas Appliance Center. Some 300 attended the affair, one of many functions designed to attract attention to the GAC and help merchandise it as the "Showcase of the Gas Industry."

sonnel, local managers — from Louisiana, Arkansas, Oklahoma, New Mexico, and other states have visited the center.

Hundreds of home builders from throughout the Southwest have visited the center and been exposed to the newest in gas appliances . . . and it has paid off in an increasing number of new homes equipped with modern gas appliances.

Commercial representatives from 46 foreign countries toured the center . . . their visit the focal point of a precedent-shattering Dallas Diplomats' Day, designed to promote the city as an international trade center.

Key executive and sales personnel groups from the home offices of participating manufacturers are frequently found at the center as visitors.

Daily traffic through the center gets results, too. A look at the notes kept by manager Tom Fisher reveals many interesting f'rinstances:

- An Oklahoma couple, operators of a small town furniture and appliance store, "dropped by for a look," stayed most of the day, ordered a score of new ranges and heaters before departing.
- A Fort Worth homebuilder decided to "go gas" after examining representative lines of built-ins, water heaters, and central heating-air conditioning equipment.
- A kitchen designer, planning a futuristic kitchen for display at the State Fair of Texas, chose a gleaming white Gold Star range after a visit.
- An LPG dealer from South Texas, touring with a group from the Texas Butane Dealers Association Convention in Dallas . . . bought a 3½-ton gas air conditioning unit because he "liked it."
- A furniture store executive from Kansas became so interested in gas air conditioning during a visit that he decided to install gas-fired cooling equipment at his store.
- A Louisiana appliance dealer became interested in several gas appliance lines, was "signed up" as a dealer for those lines.

There's no such thing as a routine day for manager Fisher or the Center's attractive, competent hostess, Mrs. Loyce Campbell. When not busy with market days or escorting visitors through the Center, they are busy working on plans for the future.

They have plenty to look forward to . . . such as the American Gas Association annual convention scheduled for Dallas in 1961.

Between now and that convention, there'll be another dozen "markets" in the Trade Mart, all of which can be expected to bring heavy traffic to the center.

Colleges and highschools throughout the Southwest have been invited to bring their home economics classes to the Center for a tour and look at the newest in gas appliances. Many have accepted and are scheduling field trips throughout the school year.

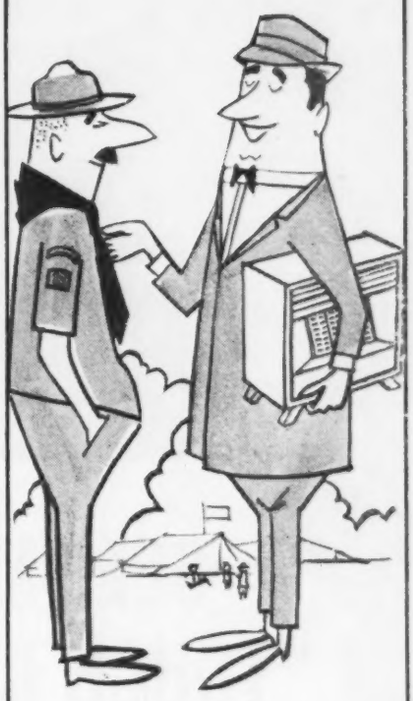
An *"Industry of the Future"* exhibit is being planned for the Center's industry exhibit area . . . to display exciting new developments of gas industry research.

Financial and business groups are also being invited to visit the Center . . . their visits calculated to boost the prestige of the gas industry.

The Trade Mart is studying a special *"Appliance Market Week,"* spurred by the reception given to the Gas Appliance Center.

Planning is underway for greater promotional effort for the center and for more "hard" sell by staff, exhibitors,

EVERYONE'S A CUSTOMER FOR A **DEARBORN**

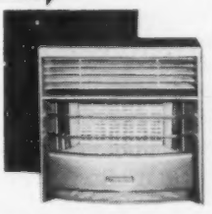


"Beats hell out of rubbing two sticks together!"

And not only does it heat better . . . it looks better. As our friend the Scoutmaster already knows, from having Dearborn *area* heating in his home. There's just no end to Dearborn's advantages, whether you consider its smart styling, precision engineering or lasting durability. It's the world's best heating buy . . . for you or for your *customers!*

FORWARD HEAT FLOW

Means faster heating, with all the warm air directed forward into the living area. Prevents discolored, streaked walls and ceilings.



The Dearborn Crest is the world's finest unvented gas area heater, a standard of quality for the heating industry.

Dearborn

Get details of Dearborn's clean-cut selling policy from any of these regional sales offices: Atlanta, Chicago, Dallas, Los Angeles, San Francisco.

1960 Dearborn Stove Co., Dallas

SELL MORE "TOUGH BUYERS" WITH REZNOR...

more types and sizes of gas-fired heaters to choose from!

Now you can satisfy "tough buyers" with just the right model heater for every job. The Reznor line features more types and sizes than any other! Choose from:

- Money-saving, space-saving unit heaters with three control options, propeller or blower fans, 25,000 to 30,000 Btuh.
- Low cost, versatile duct furnaces in capacities of 50,000 to 300,000 Btuh and up, for central heating, year-round air conditioning, or heating of make-up or process air.
- Matching, quiet-operating blower packages, if a separate air handler is needed.
- The new Reznor Venter, an automatic vent exhauster that lets you install Reznor unit heaters almost anywhere.
- Effective, five-way heaters for high ceiling applications, 300,000 to 600,000 Btuh.
- Heavy duty, forced air heaters, 400,000 to 2,000,000 Btuh, that you can floor-mount or suspend, and use with air discharge nozzles or ductwork.

Ask your Reznor representative for a copy of Catalog SA-5900, with complete data on all Reznor heaters. Or write Dept. 66X, Reznor Manufacturing Co., Mercer, Pa.

REZNOR HEATERS

"WORLD'S LARGEST SELLING DIRECT-FIRED HEATERS"

Spectacular. Giant fountain in Trade Mart's Grand Courtyard is big attraction for visiting dealers, buyers, builders, contractors, architects, and others visiting the GAC. Surrounding fountain is "open air" restaurant, coffee shop, etc., all inside building. Mart facilities also include private club, banquet rooms, conference rooms, etc.

and utilities during the market weeks.

Area gas utility companies are being urged to participate even more than in the past . . . by scheduling tours of the center and conducting contests, etc., in cooperation with the center.

Dealer and homebuilding groups are being invited to visit the Center . . . and special "nights" and "Open houses" are scheduled to attract these important buying groups.

Expansion of the industry exhibit area program to include "new and exciting" ideas from research will be of continuing benefit to the industry. Frank C. Smith, chairman of the Gas Industry Development Committee for A.G.A. and chairman of the board for Houston Natural Gas Company, sees the Center as a sounding board for tomorrow's ideas in gas appliances and equipment.

By displaying current developments, exposing them to comments from professional buyers, the industry will be in better position to improve its competitive position in years ahead. Appliance development efforts could be greatly stimulated in this manner.

Success of the Gas Appliance Center during its first nine months of life isn't impeding plans to make it greater. The Center plans further expansion, adding additional manufacturer-exhibitors by year's end. As a top executive of a leading gas appliance firm succinctly puts it, "the manufacturer who isn't in the center is losing a lot."

"Our success," adds Dave Kerr, "may prove a springboard eventually for similar Gas Appliance Centers in other areas. We've proved the idea is sound, profitable, and of value to the industry." ★ ★ ★

The Measure of an Executive

John O. Tomb, *McKinsey & Company, Inc., Chicago*

WASTE OF EXECUTIVE MANPOWER can be traced to three primary causes:

- **failure to establish tangible yardsticks for measuring performances,**
- **management resistance to executive appraisal, and**
- **failure to take a tough-minded attitude toward appraisal of performance.**

On the first score, intangible factors, such as ability to plan, to make decisions, to organize current operations, etc., have received too much consideration in performance appraisal programs. They are highly susceptible to wide swings in interpretation, depending on the individual who does the rating and on his own personal set of values. Furthermore, characteristics that often lead to a low rating on some of these intangible factors, may in fact, be the very traits that produce unusual success.

For example, a chairman of a large corporation is extremely poor at long-range planning, but he has an unusual knack for making highly intuitive — even impulsive — decisions that have led to extremely profitable results.

The president of another company not only has no sense of how to organize a team, but he operates a one-man show of the worst sort, as far as concepts of organization structure, definition of responsibilities, etc., are concerned. On the other hand, however, he possesses rather unique personal leadership and product development skills that have generated outstanding profit results.

A third top executive has a general reputation for almost complete lack of emotional stability. But he is highly resourceful and intuitive, both in terms of share of market and profit improvement.

Identical Compensation?

Even when tangible performance yardsicks have been developed and accepted as a useful management tool, many companies run into trouble because of unwillingness to clearly distinguish between the performance of one executive and the nature of the job done by his associates. Often three or four executives receive identical compensation, although one is contributing much more, or much less, than the others. Is management afraid to face up to the choice involved in distinguishing between individuals? Yes, and it often takes the easy way out and treats men who are quite unequal in performance as if they all are doing an equally good job.

Some companies kid themselves into thinking they have an "incentive compensation" plan. Its purpose, they say, is to encourage and then reward better performance. But does it? The practice of rewarding performance is a one-way street. Incentive payments move up; never down. Not so with the performance of people. Some executives *"peak out"* earlier than others. Some even begin to lose ground, in terms of comparative performance. Yet many companies continue to reward them as if they still were at their peak level of performance.

To raise evaluation of executive performance to a level that justifies the time involved in the appraisal process and simultaneously makes a badly needed contribution to management development, **two things must be done:**

1) **management must develop practical, realistic and tangible yardsticks for measuring executive performance, and**

2) **management must learn how to administer the results of this yardstick in a way that truly rewards good performance and penalizes poor performance.**

What management needs to do is to develop a basis for measuring executive performance in more concrete terms . . . in a way that will introduce a more dynamic element into the way each executive approaches his task.

Let Each Set His Own Yardstick

If, as part of the annual planning process, each executive will set down specific steps he intends to take during the year in order to help accomplish the overall sales and profit goals established for the company, he will be setting down some concrete action programs that will guide his own efforts during the coming year. He will also be establishing some tangible yardsticks against which his own performance can be measured.

A purchasing executive, for example, can identify all components whose value, in terms of performance characteristics, is 15% or more in excess of the value provided in competitive products. He can secure quotations from vendors for substitute components used by competitors. He can arrange with engineering and marketing for

their substitution. He can determine all items now purchased by the company's several divisions which are not purchased on a national contract basis, and then negotiate national contracts for those items.

The action program of the financial executive of a large corporation might include negotiating with the insurance carrier for the consolidation of all public liability policies carried by the company throughout the world, and reviewing insurance coverage to determine whether self-insurance would result in lower long-term cost to the company.

In the marketing area, it is much easier to set action programs of a specific nature. Here the approach taken deals with such factors as additional products; changes in the number of dealer outlets; changes in the size of the field sales force; modification in the nature and content of advertising and promotional effort, etc.

The key point in this approach is to push into the background the measurement of those highly abstract and often very debatable personality traits, such as aggressiveness, maturity or initiative. In their place, **focus attention on doing the things that need to be accomplished** if the company is to progress toward the short-term and long-term objectives.

This approach establishes a specific basis for measuring performance. It creates a yardstick with which there can be less disagreement, because by the time the appraisals are made, the planned action either has been taken or it hasn't, so there isn't much room for dispute. In addition to providing a means of measuring performance, you are taking the first steps toward an integrated approach to planning the operations of your company and then controlling performance against those plans.

Obviously this approach requires more effort than does the traditional appraisal process. First of all, the **yardsticks** used in measuring executive performance **are tailored to each individual.** Furthermore, **they probably change from year to year.** Therefore, both the individual being appraised and his superiors must put a fair amount of time into developing each year's yardsticks.

This being the case, the very least to be expected of top management is that it apply the yardsticks in a way that truly rewards good performance and penalizes poor performance.

Acknowledgment

Adapted from a presentation, *"Appraising Executive Performance,* at the Blue Grass Conference of the Controllers Institute of America, May 1960.

* * *

LOAD BUILDER

Gas HEATS Outdoor Swimming Pool

GAS-CONSCIOUS ARKANSANS are using gas for everything . . . One is even using it to warm a spring.

J. D. "Cactus" Clark, owner and operator of Lakeside Pool and Cafe at Lake Atalanta near Rogers has found that by installing gas-fired water heaters to maintain a constant comfortable water temperature at his pool he can stretch the swimming season — open earlier in the spring and close later in the fall.

And the swimmers love it. They can also enjoy the pleasure and distinction of swimming in the only-heated outdoor public pool in the North and West Arkansas area.

Differing from other swimming pools in the area that treat, filter, and recirculate their pool waste water, Lakeside heats, treats, filters, and adds daily 30,000 gal of fresh spring water. The pool's waste water is discharged and not re-used.

Under past operations the adding of fresh water affected considerably the temperature of the water in the pool. To overcome this fluctuation in water temperature and to offer the public the best in recreational facilities, Clark called on Arkansas Western Gas Company to install two natural gas-fired Ruud multi-coil water heaters to heat the pool water.

Water capacity of Lakeside Pool is approximately 300,000 gal. For its initial filling, the daily addition of fresh water, and for continuous filtration, Lakeside utilizes a natural gas engine-driven water pump with a capacity of 600 gal per min. Approximately nine hours are required for the initial filling of the pool.

The two gas-fired water heaters are capable of raising the temperature of the pool's 300,000 gal of water from 58 deg to 80 deg in about 96 hours. To maintain the 80-deg water temperature after the initial heat-up period requires the use of only one of the water heaters operating about 50% of the time.

Installation of the gas-fired water heaters at Lakeside has advantages other than maintaining a more constant and comfortable water temperature. Now Lakeside can offer a longer swimming season by opening earlier in the spring and closing later in the fall.

Since the pool was opened in 1948 Clark has spent over $15,000 for improvements on the pool and cafe, and is contemplating other improvements to be made in the near future which will further provide the finest of recreational facilities for the area residents.

"Situation not so hot on Chinese wall. Velly annoying—every time one of our boys would leave Great Wall to gather firewood or something, miserable Tartars would put arrow in his back or someplace. Fire from first class gas grates fed by number one quality steel pipe—like honorable Laclede—would have tempered fierce Mongolian winter and save all.
"Next time order Laclede pipe —chop chop."

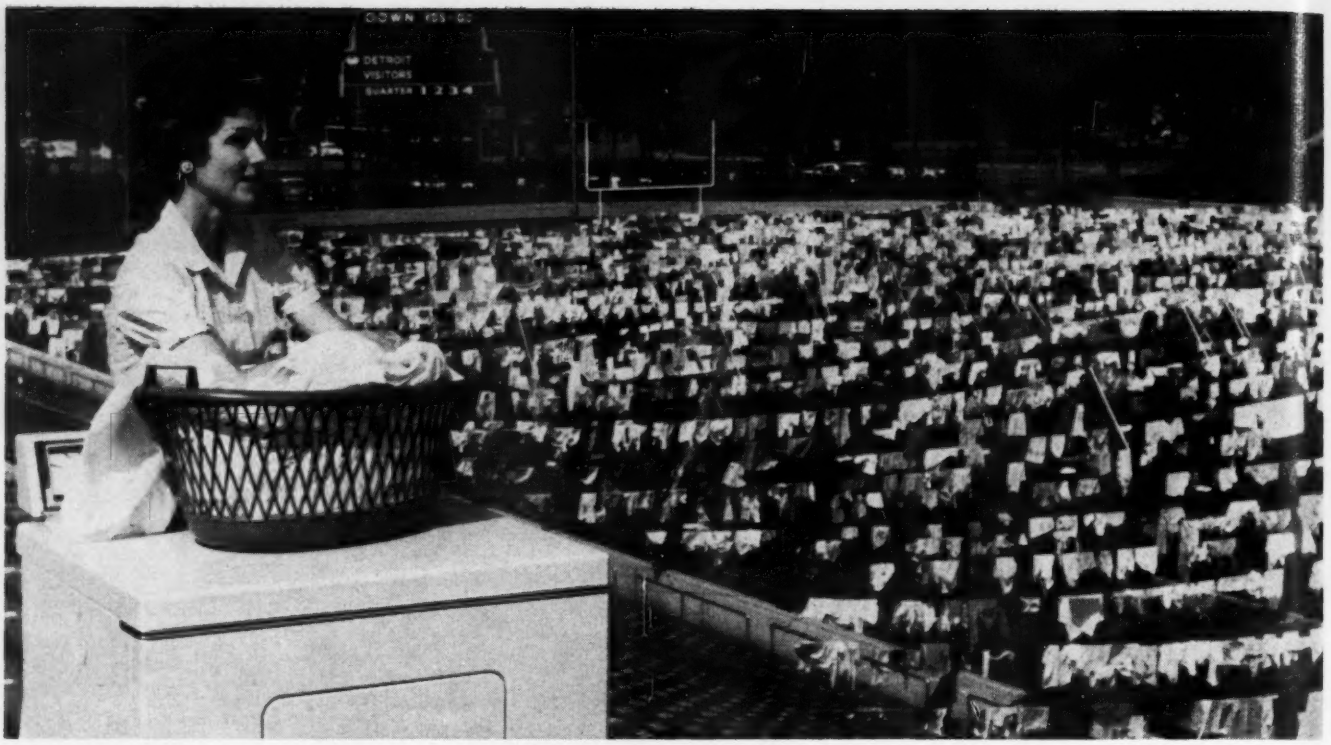
LACLEDE STEEL PIPE

Steel

LACLEDE STEEL COMPANY

SAINT LOUIS 1, MISSOURI

Producers of Quality Steel for Industry and Construction.



Mrs. Geraldine Scott, the current Mrs. Michigan, posed for photographers with the three miles of laundry that filled the University of Detroit stadium.

"Flapping Extravaganza"

World's L-o-n-g-e-s-t Clothesline Promotes Gas Dryers

For years gas company appliance salesmen have been telling homemakers how much work they could eliminate by buying a gas clothes dryer.

But like the weather, nobody ever did anything about it . . . until September 8.

On that hot, gusty day Michigan Consolidated Gas Co. sales promotion men strung three miles of clothesline and draped it with 7000 articles of clothing in the University of Detroit stadium to show just how much work is involved in hanging up a year's washing for a family of four.

Mrs. Geraldine Scott, the current Mrs. Michigan, was enlisted to pose with a basket of laundry and a gas dryer mounted high in the grandstand. The local press, television and Life Magazine were invited along with appliance salesmen to take a look. They all loved it.

The results were spectacular. All three Detroit newspapers ran eight column cuts on their back picture pages and gave credit to Michigan Consolidated and gas dryers in their story length captions. The Associated Press carried the picture on its national wire and Life Magazine photographed the flapping extravaganza. Two television stations featured it in their news broadcasts.

The publicity preceded Michigan Consolidated's "Dryer Dividend Days" sales promotion in which the company cooperates with appliance dealers.

Most of the credit for the unusual promotion goes to Jerry Seitz, superintendent of sales training and promotion for Michigan Consolidated, with an assist from the press relations department. Seitz dreamed up the idea which met with enthusiastic approval from Wilbert Glines, Detroit district sales manager, and Fred A. Kaiser, vice president and general sales manager.

But, like most grandiose ideas, there were a few hitches that had to be ironed out, like:

Where do you find a place big enough to hang three miles of clothesline?

Where can you get three miles of clothesline?

Where do you get 7000 items of clothing?

The first was the easiest. Seitz, a University of Detroit alumnus, called Robert Bedard, alumni secretary for the University, who agreed that if Seitz was

crazy enough to do it, he'd go along with the gag.

The clotheslines turned into a real problem. Two dozen calls proved that clothesline just doesn't come that long. Finally Charles Helpenstine of Boyer Campbell, Detroit industrial and safety company, heard about Seitz's dilemma and offered the rope which he had to order from Boston.

So now all that was left was the laundry.

Home laundries were not the least bit interested. They told Seitz: "Man, we'd just as soon you never sold another gas dryer as long as you live . . . they're ruining our business."

A commercial laundry offered 1000 barber's jackets, 1000 maid's uniforms, 2000 sheets and pillow cases and a few thousand towels, which were hardly representative of home laundry.

At home that night, Seitz's wife Maureen asked him if he minded giving some of his old clothes to Goodwill Industries. The problem was solved. Early the next morning Seitz called John E. Hoskins, assistant executive director of Goodwill who was delighted to provide the laundry.

The day before the picture taking, Seitz and his crew strung the rope, crisscrossing the field 50 times, and tried one line of clothes to see if it would hold. Two poles seemed to be enough.

Thursday was hot — 92 degrees — as the crew labored to hang the clothes over the lines. The wind began to blow, and it was apparent that at least six clothes poles would be required for each line.

Jerry Seitz and Wilbert Glines of Michigan Consolidated's sales department, look at their favorite pin-up pictures which were featured in all three of Detroit's daily newspapers.

An hour before the photographers were to arrive only a little more than half of the clothes were hung as clothes flew through the air, poles buckled and lines got tangled. A hurried call to the shop department brought aid and more poles, and everything was ready when the newsmen arrived.

It was still a never ending battle to keep the lines up during the picture taking session which lasted over two hours.

Exhausted and sunburned, the sales promotion men were not too sure their boss had had such a great idea . . . until they saw Friday's papers. "Dryer Dividend Days" was off to a whale of a start.

* * *

All available hands were needed to hang out the world's longest clothesline.

THE MARK OF THE 100-YEAR PIPE

For ruggedness where you need it the most...

CAST IRON PIPE MECHANICAL JOINTS

Cast iron pipe manufacturers insure extra flexibility by the use of a mechanical joint that will withstand normal distribution pressures. Vibrations, washouts, heavy surface loads—mechanical joints resist them all, and the design of the joint permits deflection of the pipe during and after installation.

Ruggedness inherent throughout cast iron pipe

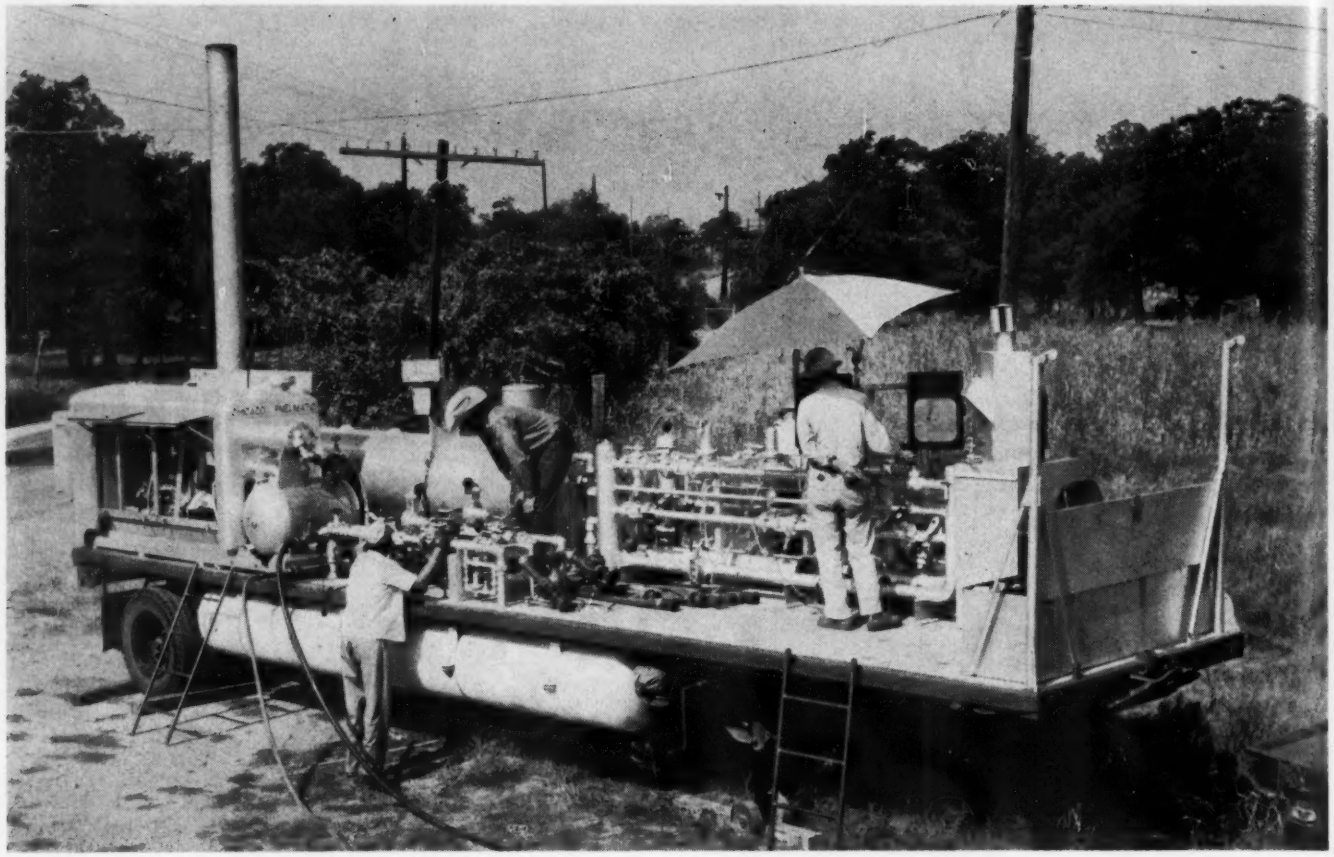
The joint is merely an example of cast iron pipe's toughness. Modern cast iron pipe also offers *great beam strength*—to resist heavy traffic above, and shifting soils below; *tremendous load resistance*—6" cast iron pipe withstands a load of nearly 9 tons per foot; *corrosion resistance*—to withstand most adverse conditions.

Most important of all is the fact that once you have laid cast iron pipe, you can generally anticipate *no major repairs for at least a century!*

Write for complete information to Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 3440 Prudential Plaza, Chicago 1, Ill.

...all good reasons for you to choose

CAST IRON PIPE



On the job, mobile propane-air plant developed by Lone Star Gas Company is impressive in appearance. Completely self-contained plant is mounted on a 32-ft square front trailer. Floor plate is of aluminum to save weight. Beneath floor are two 318-gal propane storage tanks. Left to right, above floor, are the 210-cfm air compressor; horizontal shell indirect water bath heater (behind compressor) with hinged stack that lowers for road travel; first stage propane regulator manifold (in front of air compressor); regulator-mixer manifold (right center), and metering and control area at right. Two lines in foreground connect a propane tank truck (dark hose line) and an auxiliary air compressor (light colored line).

Mobile Propane-Air Plant

. . . A Tool for Maintenance and Emergency

F. Zapffe, *Design Engineer, Lone Star Gas Company, Dallas, Texas*

A MOBILE SELF-CONTAINED PROPANE-AIR PLANT is another operational tool that has been added to the available equipment of Lone Star Gas to more efficiently cope with the unique operation and maintenance problems of the company.

Lone Star operates in a square area approximately 385 miles on a side. Within this 150,000 sq mile area, gas is supplied to some 462 towns and communities. Many of these towns are at the end of a single tap line. Some have as few as 100 domestic meters. The towns graduate in size up to Fort Worth and Dallas in the center of the square.

Experience has demonstrated that the most economical maintenance to these single tap lines can be made by supplying a propane-air substitute gas to the individual town while the tap line is taken out of service for repair.

In 1951, such a tap line maintenance problem prompted the hasty three-day construction of a mobile propane-air plant to supply a 1000 Mcf per day demand rate. (Reference: *Gas-Age,* January 31, 1952) The continued use of that unit developed short-comings that have prompted the design of a new unit to help expedite the routine maintenance throughout the system.

Major objections to the original propane-air unit were:

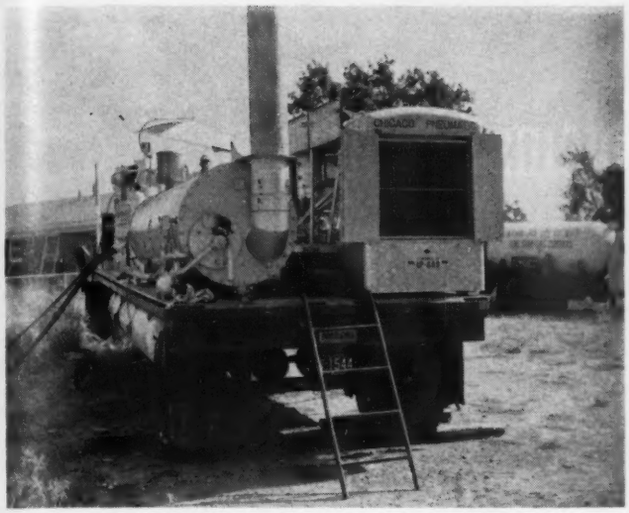
1) It was limited to a maximum of 1000 Mcf per day rated output of mixed gas by the heat capacity of the liquid propane vaporizer.

2) It had no self-contained air compressor, requiring a separate truck to haul a standard air compressor for even the smallest job.

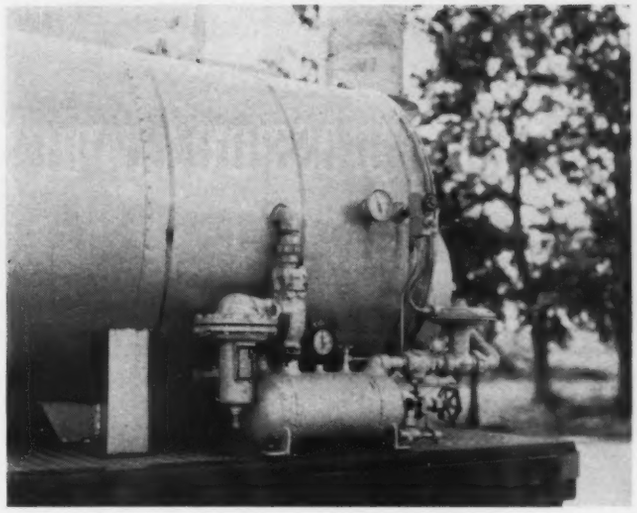
3) It had no propane storage, requiring a propane transport for every job.

New Unit Designed

The challenge in designing the new unit was to concentrate the maximum



Heater and air compressor viewed from rear of trailer. Heater is horizontal shell indirect water bath type, thermostatically controlled, and is fueled by propane vapor.



Fuel regulator assembly for heater and engine. Thermostatic control for heater is at right. Tank at bottom center is a "drip pot" to catch any liquid propane that might come through the fuel line.

potential output capacity into the unit that it might be available for emergency operation as well as planned maintenance, yet make the size and weight suitable for rapid movement over the highways. Consideration had to be given to the very small jobs that would be difficult to control if the equipment were sized only for the maximum job. Economy of operation on the small jobs had to be considered.

The result was a mobile plant that contained one 210 cfm air compressor, two 318-gal propane tanks, vaporization capacity of 1,025,000 Btu per hour, and identical parallel regulator trains of piping, each train capable of one-half of the total output. The unit is mounted on a standard 32-ft semi-trailer that can be hauled by any one of the many company two ton tractor trucks. Several designated pipeline department personnel are capable of single-handed operation of the unit.

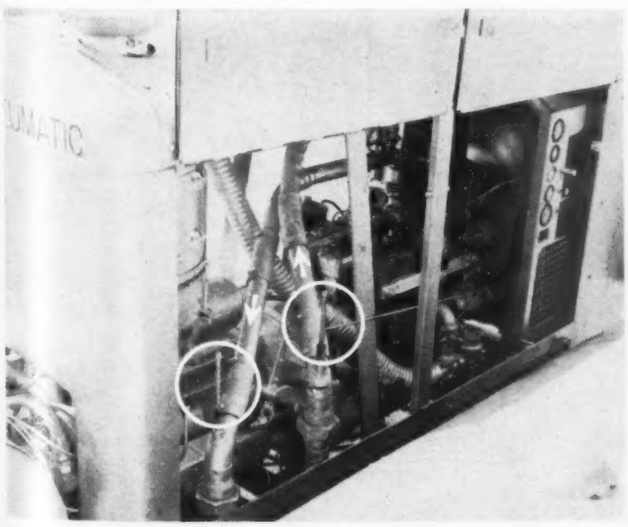
The unit, once rolled into position and connected to the 30 psig operating pressure system in the town plant by special 2½-in. fire hose, can, without additional connections, supply a total of 36,000 standard cu ft of substitute sendout gas at the maximum rate of 30,000 cu ft per hr, limited only by the capacity of the 210 cfm air compressor.

In case of an emergency, this first hour of operation might hold a town until an additional 329 cfm capacity of air compression could be connected to the 2-in. auxiliary air connections and a shuttle of propane transports could connect and deliver 1435 gal per hr of liquid propane. With these auxiliary supplies, the plant can deliver at the continuous rate of 2000 Mcf per day at 70 F, and 1500 Mcf per day at 0 F atmospheric and liquid propane temperature.

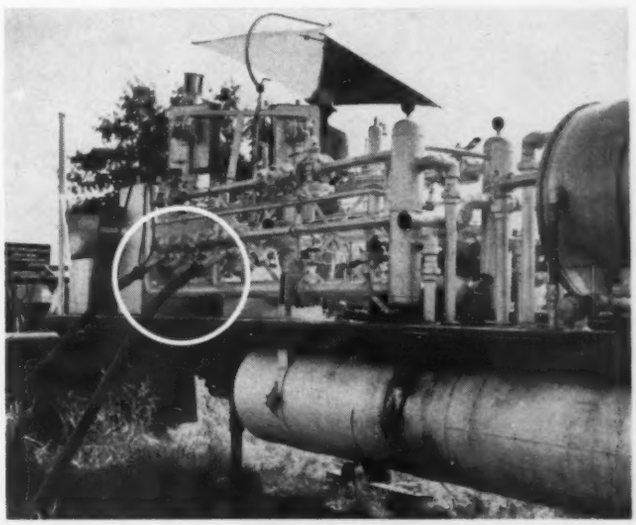
Gas Interchange

The unit is designed to deliver a stabilized gas of 1519 Btu per cu ft. This is composed of 38.8% air and 61.2% commercial propane. The 1519 Btu sendout gas is interchangeable with natural gas of a 1323 interchange value. The interchange value is determined by dividing the heating value of the gas by the square root of the specific gravity. Thus, a propane-air mixture of 1519 Btu and 1.32 specific gravity will properly burn in any appliance that is adjusted for any natural gas whose heating value divided by the square root of the specific gravity will equal a value of 1323.

The operation of the mobile unit will permit adjustments to deliver a substitute gas for natural gas that differs from the 1323 interchange value. While theoretically a 1500 Btu substitute gas should require a smaller volume send-



Engine water is by-passed from engine block (by closing valve) to heat exchanger beneath trailer floor and returned to engine radiator. Arrows show direction of flow. Inlet and outlet temperature is indicated by thermometers (circled).



Regulator-mixer manifold is located at left front of trailer. Metering and control area is at front of this manifold. Outlets for sendout gas are circled. Two of three are shown connected.

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Within a single, integrated plant, American Car and Foundry designs, engineers and manufactures pressure vessels for a wide range of storage and transportation requirements for pressurized liquids and gases. Equipped with modern production line fabricating facilities for both ferrous and nonferrous metals, American Car and Foundry meets the most rigid demands and specifications of all pressure vessel codes.

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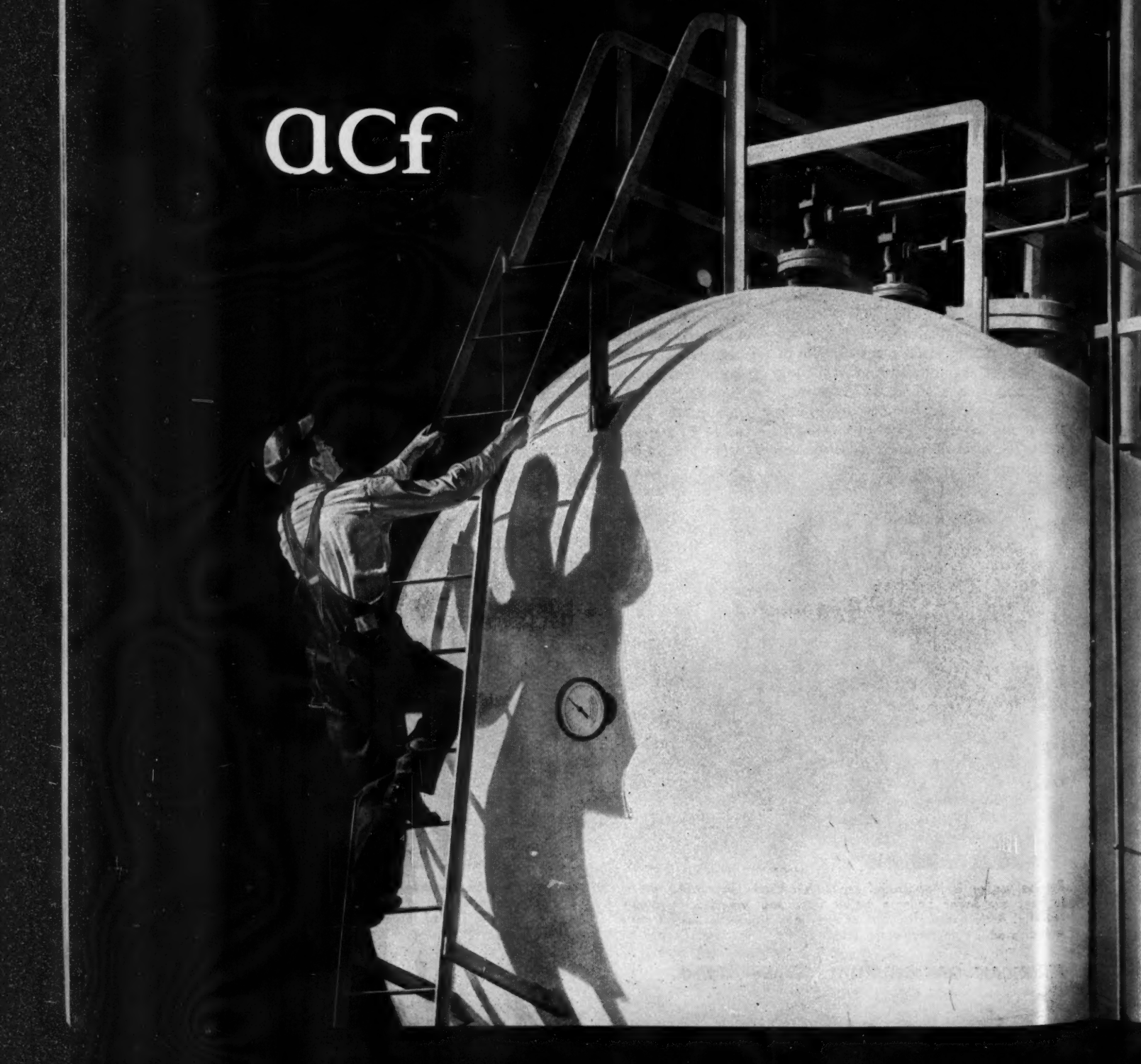

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- Large stress relieving furnace–up to 12 ft. diameter, 120 ft. long.
- Complete X-Ray facilities.
- Steel grit blasting before priming.
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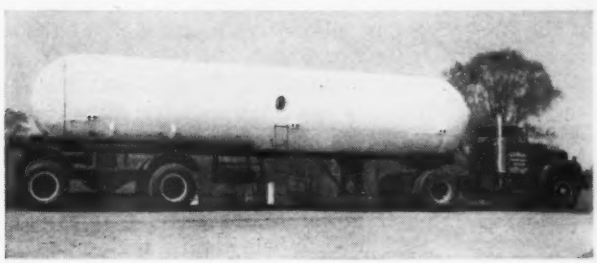

T-1 "Bonus Blimp" LPG Transport

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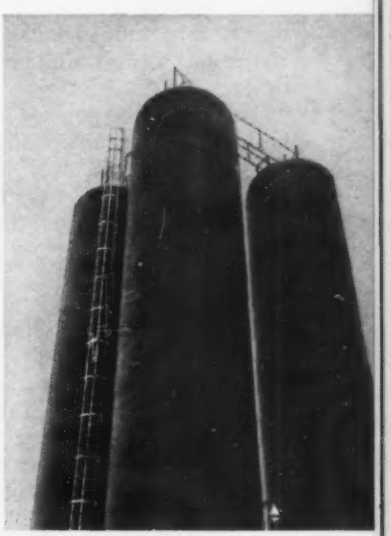
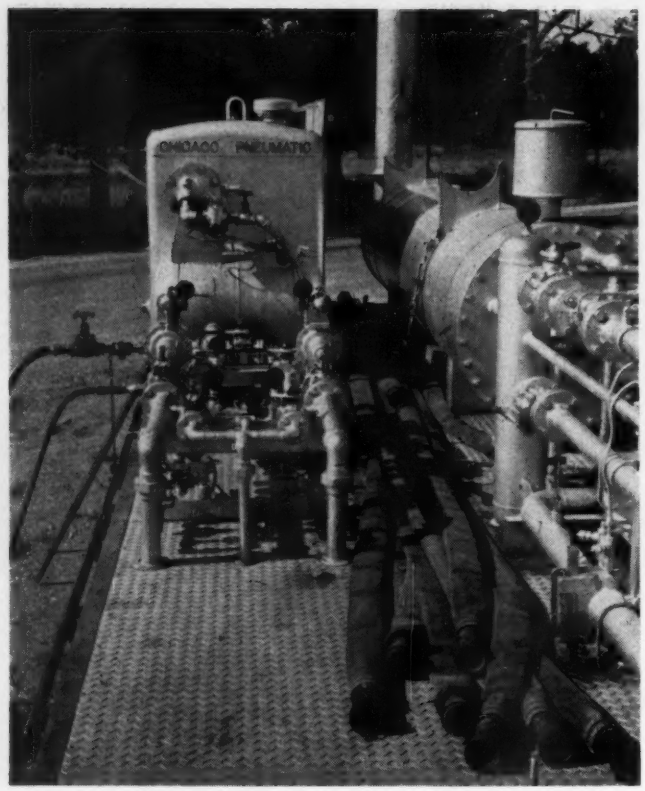
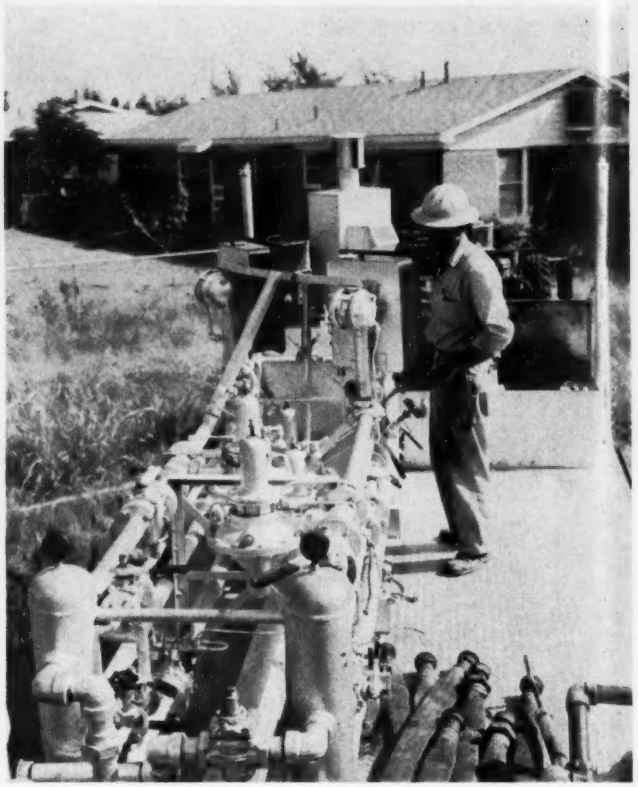


Vertical LPG Storage Tank



First-cut regulator manifold for propane is directly in front of air compressor. From this regulation stage, outlet pressure of propane is approximately 50 psig. Propane then enters heat exchangers under trailer floor in a two-phase condition at 28 F, is further vaporized, and then goes to main heater. Regulators are pilot operated. Gages are for upstream and downstream pressures.



Regulator-mixer manifold has two trains of identical parallel piping and equipment, each capable of one-half the total output. At rear, operator checks instruments to determine if sendout gas values are correct. Plant has manual controls; uses dry bellows meters, specific gravity meter, and test flames as checks on gas output. Propane stream regulation uses sensitive pilot regulators. Output pressure is approximately 30 psig.

out than that required for the normal supply of 1000 to 1100 Btu natural gas, all estimates for planned operations allow for equal volume replacement because many appliances, i.e. pilot lights and commercial applications, are on a manual setting and cannot take full advantage of the increase in heating value per cubic foot of gas.

The basic components of the plant are standard commercially available items, selected for their rugged construction to withstand the rigors of the over-the-road travel and the usual type of pipeline operation.

Trailer Design

The semitrailer selected is a 32-ft square front, 20,000-lb single axle, center frame, platform trailer with all standard components. The only particular requirements were that it have clear areas under the floor on each side of the center frame to provide room for the two propane tanks, and that it be delivered without flooring.

Aluminum floor plate was later installed, cut to conform to equipment location and to provide for under floor maintenance of piping and valves.

Air Compressor

Mounted on the right rear corner of the trailer is a standard 210 cfm rotary two stage air compressor with gasoline engine modified for propane fuel. Full coverage housing was retained for weather protection during storage and operation. The four wheel running gear was replaced with a skid mounting. This skid is rubber shock mounted to the trailer frame.

In operation, the compressor runs smoothly and does not adversely affect the recording flow meters. The unit is complete with starter, generator, and battery to start the unit and to supply 6-volt power to the Ranarex gravity meter used to help control the sendout gas.

Engine Heat Used

Two modifications were made in the standard piping of the compressor. The engine jacket hot water line at the cylinder head thermostat outlet is modified to permit the hot water to flow to a heat exchanger to help vaporize the propane. The cooled water returning from the propane heat exchanger is directed to the engine radiator to further cool the water if sufficient heat is not removed in the exchanger under partial sendout load conditions.

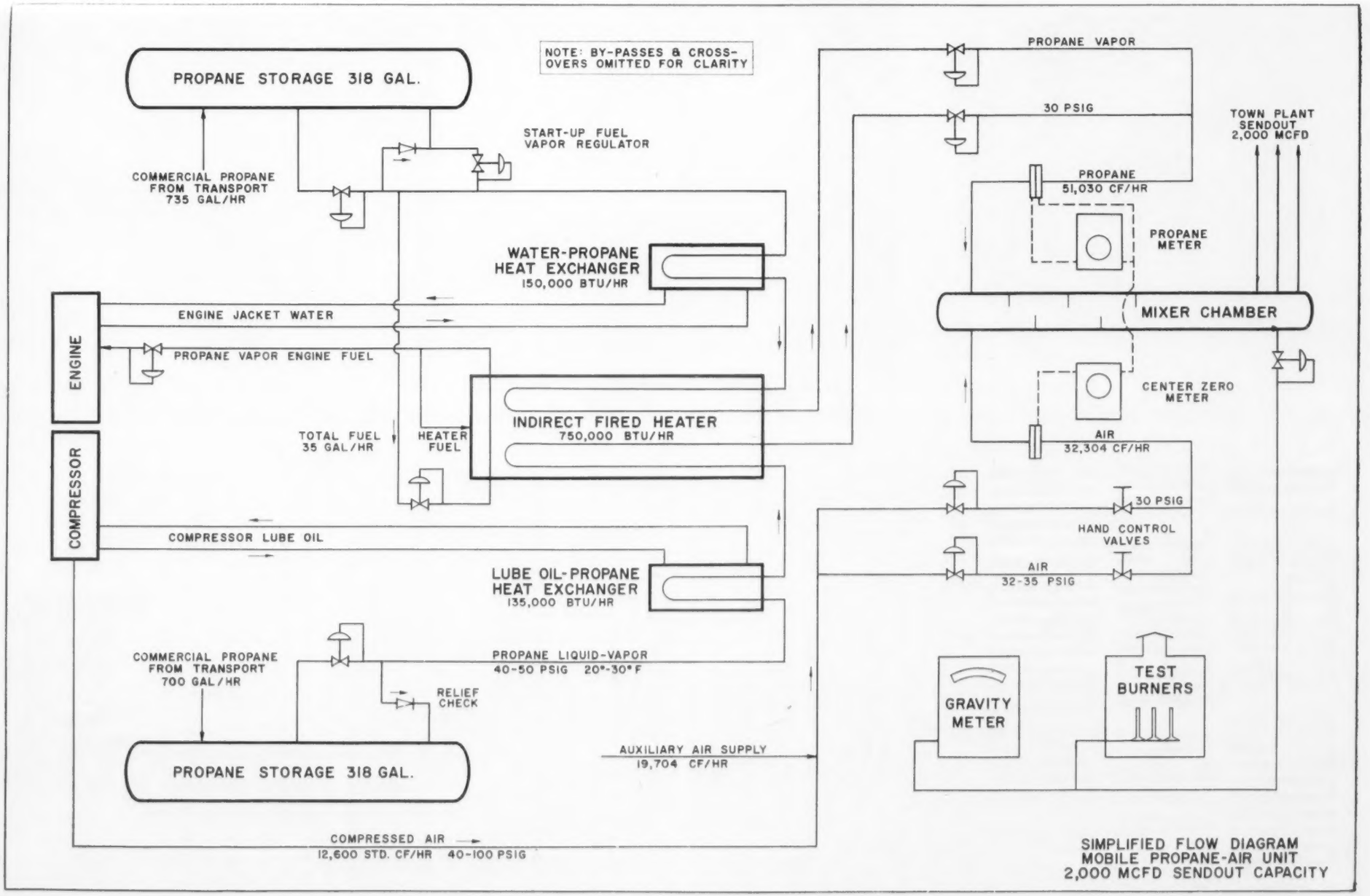
In the rotary type compressor, all cooling is accomplished by cooling the lube oil in a cooling coil in front of the engine jacket water radiator. The oil is diverted from the oil temperature thermostat outlet into the second propane vaporizer heat exchanger before the oil flows to the cooling coil for further cooling.

An interesting point in the operation of these two heat exchangers is that on a hot day, so much heat is taken from the engine water and the compressor oil, that both streams are cooler than the air temperature and the unit acts as a heat pump extracting a small amount of heat from the air passing through the radiators.

Propane fuel vapor is provided to the compressor engine from a fuel regulator located on the heater. The heater fuel also comes from this fuel regulator.

Heater

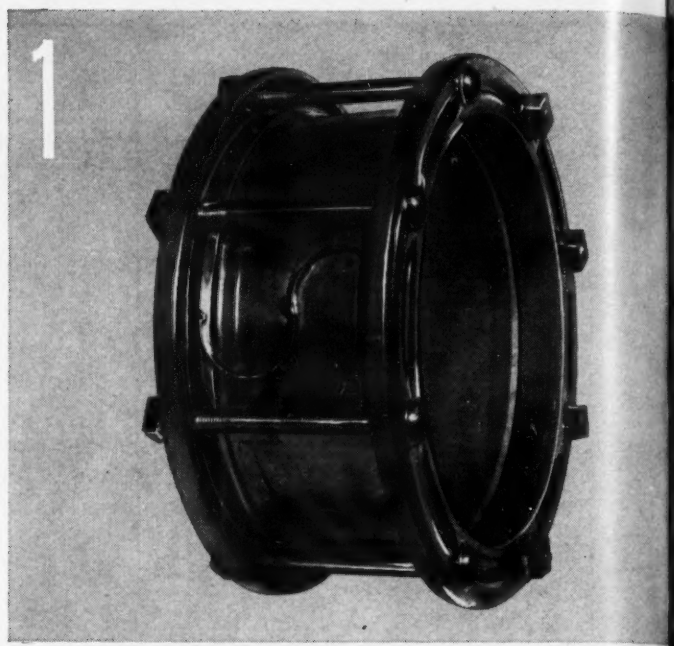
The heater, mounted on the left rear of the trailer, is a horizontal shell indirect water bath heater that is common to oil field operation. It is 30-in. in diameter by 12 ft long. The fire tube is a return bend type containing 24 ft of 10-in. standard weight pipe. The propane is contained in two coils of 2-in. standard pipe, each coil consisting of 8 lengths or 56 sq ft of surface. One length of 1-in. pipe is used for a fuel vaporizer upstream of the fuel regulator.



SIMPLIFIED FLOW DIAGRAM
MOBILE PROPANE-AIR UNIT
2,000 MCFD SENDOUT CAPACITY

6 SHORT STEPS TO GREATER SERVICE IN GAS DISTRIBUTION

1. Coupling mains and service lines is simple, effective and saves you money. Take a Dresser® Style 123 factory-assembled pre-coated coupling. Initial cost is low...but the economies just start here. 2. Now take the man who makes the joint. That's right, it takes only one man—with a minimum of instruction and supervision—to make gas tight joints with the best of them. And at the rate of 2 bolts a minute. 3. Here you see part of the reason why Dresser couplings save time in the ditch. Note the pipe being stabbed into the pre-coated coupling. The complete coupling is clad in 3 coat protection —prime, coal tar epoxy resin bonded under glossy black coal tar enamel. No mess and time wasted on coating and priming hard to get at places. 4. Tightening-up the bolts to make the actual joint is quick and uncomplicated. No precision equipment to pamper, no need for protective gear...in fact the only necessary equipment is a wrench. 5. One pan of soapy water is all that's needed to check the tightened joint. No elaborate testing devices. Just paint it on and check for bubbles. It's as simple as that. 6. Last the connection gets a quick touch-up and the joint is done...ready to "live" in the ground taking the worst that weather, ground settlement, vibration and line pressure can offer.



Dresser couplings save you money. Initial cost is low and maintenance and repair problems are simplified or eliminated. They save valuable time because they're precoated and assembled, quick and easy to install even when there's not much elbow room. Entire systems can be coupled right in the ditch with no need for tricky lowering of pre-joined lengths and the expensive equipment involved. ■ Economical gas distribution, construction and repair calls for couplings and repair products developed specifically for the gas industry. This has always been Dresser's prime business. Your Dresser man has any information you need on the complete Dresser line. Serving the gas industry is his only business, and, he is qualified, and eager to assist you in every way. DRESSER MANUFACTURING DIVISION, 61 Fisher Avenue, Bradford, Pennsylvania.

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4

5

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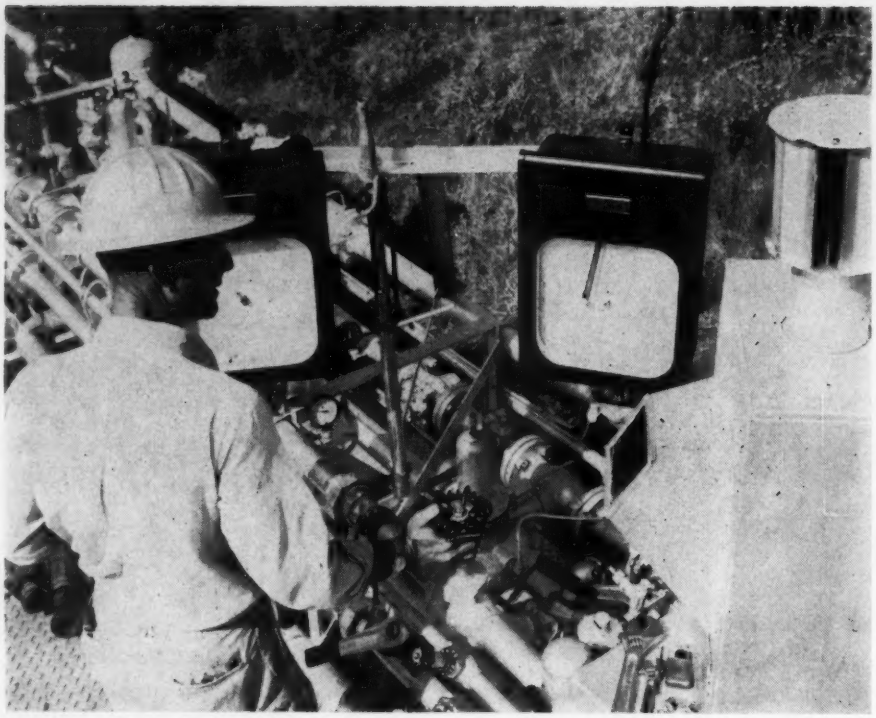


Operator has three checks on sendout gas. Zero-center meter is directly behind operator. Propane meter is at center of photo. At left is housing for the three test burners, which are adjusted for 1) normal flame, 2) lifting flame, and 3) yellow-tip flame. Flames are first adjusted on natural gas of system to be supplied with substitute gas, then sendout gas is adjusted by manual controls to produce similar burning characteristics. Also used, but not visible in photo, is a Ranarex specific gravity meter, directly behind burner housing.

In operation, the burner is thermostatically controlled to hold the water bath at some predetermined temperature below 180 F. A temperature of 105 F is adequate to transfer to the propane all heat available from the fire tube. This heater is dependable, trouble-free, and simple to operate. It is bulky and heavy with the 315 gal of water that need be carried over the highway or filled at the job site. More sophisticated heating equipment could be used, but not as dependable and trouble-free as this unit.

Storage Tanks

The propane storage tanks are not a standard item. These two units had to be designed to fit into the available space under the floor of the trailer. They are 24-in. diameter by 16-ft overall length. A system of fixed and flexible cradle supports had to be designed to permit the tanks to be free of strain as the trailer twisted over road and ditch irregularities. Eight openings on each tank had to be exactly located to be compatible to the trailer structure.

All LPG standards had to be met and, after final design, the Texas Railroad Commission, the Texas state regulatory body responsible for transportation of LPG, had to pass on the construction drawings.

The tanks have connections (not all shown on the simplified flow diagram) to receive a 2-in. connection from large propane transports (4000 to 6500-gal capacity), a 1¼-in. connection to receive from small home delivery size trucks of 1000-gal capacity, a ¾-in. vapor return connection to the trucks so that excessive pressure will not build up in the storage tank while receiving propane, a relief valve connection, two types of level gages, a thermometer, and a pressure gage connection.

There is a crossover connection from one tank to the other for flexibility of transfer. The water capacity of each tank is 375 gal. At 85% filling limit, the propane capacity is 318 gal. The tanks can be filled to 90% capacity with butane, but butane is never used in this unit. Ambient temperatures below approximately 60 F will cause butane vapor to recondense in the regulators and measuring piping before air can be mixed.

Because of the emergency potential use of this plant, it is always kept filled with propane. In use it would be extremely difficult to control the sendout quality if butane were to be blended into a tank of propane.

Heat Exchangers

Also mounted under the trailer floor, between the major frame members, are two identical heat exchangers. Physically, the shell and tube units are 6⅛-in. shell diameter by 33½-in. shell length. The water or oil is one pass through the shell and the propane is two pass through the ⅜-in. tubes. Each unit contains 34 sq ft of transfer surface.

Propane Flow

A study of the flow diagram will show that, as the liquid propane flows from the storage tank at more or less ambient temperature, it flashes through the first cut regulator to approximately 50 psig. At this pressure a portion of the liquid flashes to vapor to produce an estimated 28 F temperature.

In this two phase condition, the propane enters the two heat exchangers and vaporizes a portion of the liquid with the available heat from the oil or water. The outlet temperature of the propane remains at 28 F and enters the main heater at that temperature.

The propane stream then leaves the heater at some superheat temperature limited by the temperature of the water bath or by the mass velocity of the propane. At full limiting heater capacity, the outlet propane temperature will approximate 40 F. Below that temperature, because of velocity conditions, liquid propane drops will occasionally carry through.

With the described major components mounted on the trailer, the balance of the plant is no more than pipe, valves, and pipe fittings. The piping is all installed in such a manner that any portion, above or below the floor can be removed for maintenance and inspection.

Design Features

Due to the complexity of the piping in relation to the trailer substructure, no formal blueprints were made. The company welder, Wylie Smith, who fabricated the plant would call the design engineer stating that he had gone as far as the previously given "verbal blueprints" would permit and indicated another design session was in order.

Regulators

All regulators have manual bypass valves as well as block valves so that regulators can be repaired while the plant is in service. Crossover valves from one side to the other are provided. Auxiliary feed points for air and propane are provided on each side of the trailer for ease of access regardless of trailer location at a job set-up.

The first cut regulators are pilot operated for increased sensitivity to permit as steady operation as possible of the flashing propane. Thus, these regulators cannot open until instrument air is provided. The air compressor cannot start until fuel is provided. Therefore, a small start-up fuel vapor regulator set at 20 psig is provided to feed from the vapor space of one tank to permit quick start up. After the instrument air activates the pilot operated regulators, the

50 psig pressure will close the start-up regulator.

A check valve from the 50 psig stage to the vapor space in the storage tank acts as a relief valve in the event a volume of liquid propane should be locked in the heater coil by a sudden shutoff of the downstream regulator. A pressure as high as 400 psig could be generated at water bath temperature of 180 F. Excess vapor will flow back into the storage tank and condense or relieve through the tank safety valve.

Metering and Control

The metering and control portion of the plant is designed on the basis that the propane and air stream will mix in the chamber at a common pressure. If the orifice plates for the meters are sized in proper proportion for the different specific gravities and volumes of the two gases, then the differential pressures across the two plates will be identical and the upstream pressures will be identical.

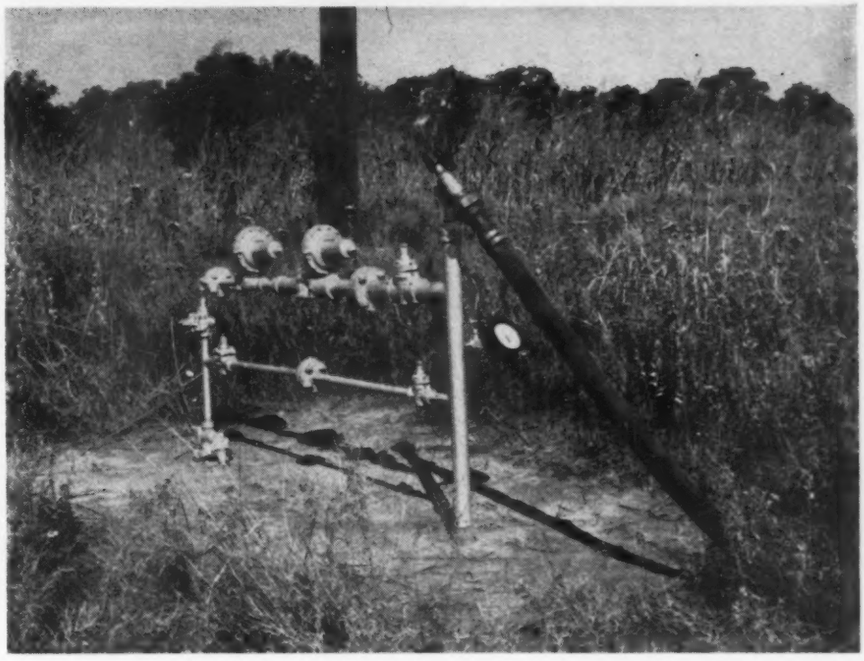
The plates are bored exactly to the sizes required. Three sets of plates in graduated capacities are provided for all possible job volumes. A propane meter is provided so that a permanent record of the volumes of propane, instantaneous rates, and total job duration can be kept.

The plant is intentionally a manually operated unit. Complicated automatic controls would perhaps be damaged in highway movement and instrument men might not be available to repair and adjust. Most all operations are for periods of only a few hours and are not too strenuous for manual operation. The meters used are the dry bellows type, not requiring leveling and zero adjusting, after a hard trip. The propane meter is conventional in its recording.

The center zero meter has a range of plus and minus 12.5 in.; i.e. a 25-in. meter. This meter is used by the operator as one of three methods of quality control.

If the plates are properly sized, then the upstream pressure on each plate should be identical to deliver balanced volumes of propane and air. If this is true, then the center zero meter connected to the upstream side of each meter should read zero.

The propane stream is regulated by sensitive pilot regulators, two to split the load for off peak sensitivity. The air stream is adjusted by calibrated globe valves, hand controlled. If the globe valve or valves are flowing the proper volume of air, the center zero meter is on zero. If off zero, the globe valve on the air stream needs to be adjusted. The chart of this zero deviation is a permanent record of the quality variation of the substitute gas being temporarily supplied to the town.



Connection to distribution system is made at most convenient point. As shown here, propane-air gas is put into upstream side of a district regulator. Connection from plant is made with a special 2½-in. fire hose tested to 500 psig. Gage on DR riser is used to check line pressure.

The three 2-in. outlet connections from the mixer chamber are coupled to the town piping by means of special 2½ in. fire hose. The dacron fabric is neoprene impregnated surrounding a neoprene inner tube. It is tested for 500 psig and is coupled by nipples with 2-in. iron pipe threads so that conventional pipe unions can be used. The hose can be stored in small tight rolls and can be fully inflated in service with as low as 10 psig. To minimize pressure drop, short lengths as possible should be used to connect the trailer to the town piping.

How It Works

In operation, the trailer will be connected to the town plant before the scheduled shutdown of the gate station for maintenance. The quality of substitute gas required has been calculated and the specific gravity of the gas has been determined. Now, the natural gas is back-flowed from the town so that three Bunsen burners can be adjusted on the natural gas.

One test burner is adjusted to be on the verge of lifting the flame, one is set to normal flame, and the third is set for a yellow tip flame. The burner house is dark with a small protected viewing window so that minor color variations in the flames can be noted.

The substitute gas is now sent out to a waste flare in order to properly check operations before sending gas into the town. The three burner flames, with no re-adjustment, should remain as seen when burning natural gas. The Ranarex indicating gravitometer should indicate the previously determined specific gravity of the sendout gas. If the desired quality of the gas for the particular job is identical to that of the design of the portable plant, then the center zero meter should read zero. Otherwise, the center zero meter will be offset to one side or the other of the zero by a definite deflection and that deflection point will become the "zero" point for this particular job. Thus, the operator has three methods of quality control at his disposal.

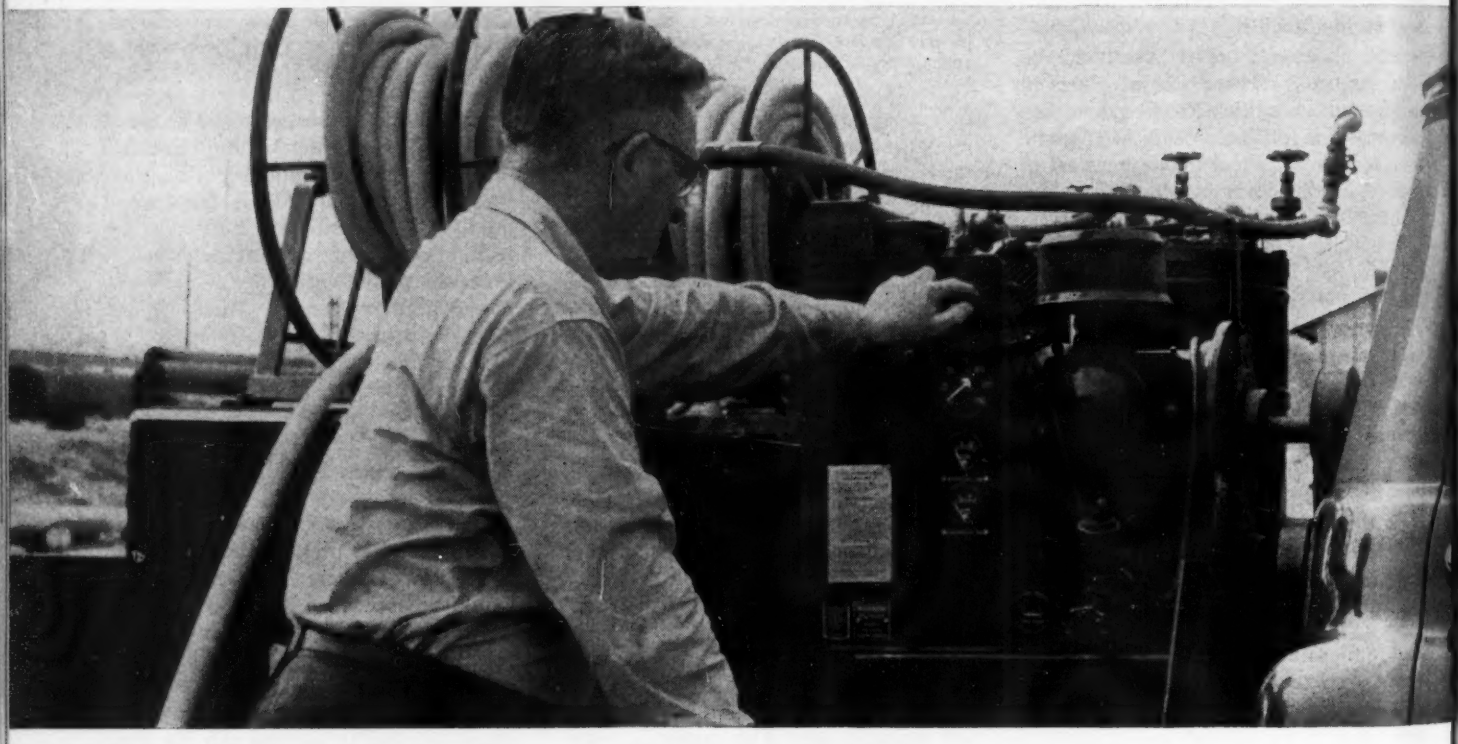
The plant was designed for 30 psig mixer chamber pressure because most of the towns where this unit could or would be used have 20 to 30 psig high pressure distribution systems. For the few that have higher operating pressures, the portable plant can be operated at any higher pressure desired. If necessary, the transports can use their unloading pumps and push the mixer chamber pressure up as high as 75 or even 100 psig. The penalty is that the vaporization capacity is lowered about 30 percent at 100 psig.

Looking to the future, perhaps mobile plants with larger sendout volumes, smaller physical size and lighter weight can be developed around the gas turbine power unit and a yet to be announced small, lightweight, high speed, high pressure rotary blower. The exhaust from the turbine can be utilized to vaporize the propane, provided the liquid fuel can be hauled to the job as fast as this "dream-boat" mobile vaporization plant can mix the sendout gas.

* * *

↑ New England Utility* BOUGHT 1—RE-ORDERED 4 MORE

↓ Eastern Utility* BOUGHT 1—RE-ORDERED 4 MORE



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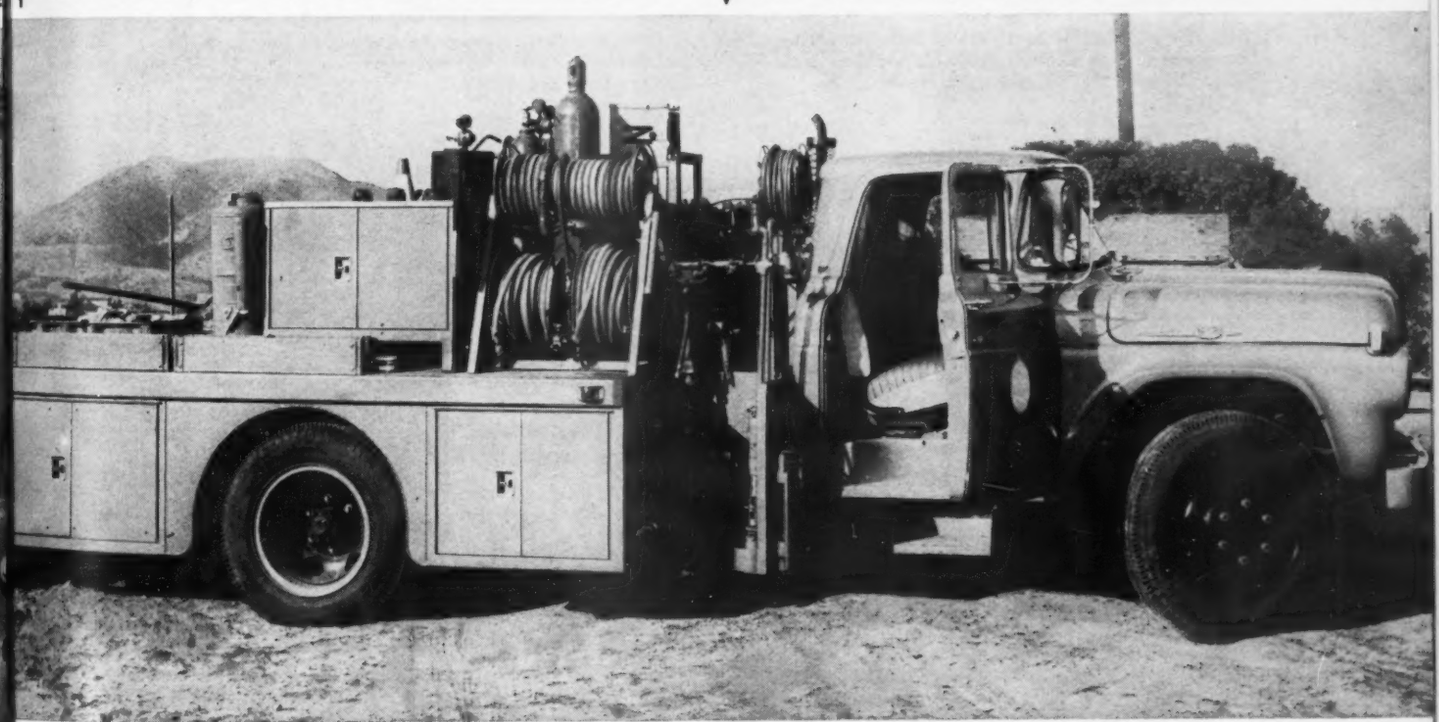
↑ Midwest Utility* BOUGHT 1—RE-ORDERED 7 MORE

↓ West Coast Utility* BOUGHT 1—RE-ORDERED 9 MORE



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DISTRIBUTION DEVELOPMENTS

NEWS ABOUT CURRENT AND PLANNED CONSTRUCTION

Regulator station? Yes, and it's no accident that the new Union Road regulator station (house in background) looks like all the other houses in its residential area. Laclede first tried out this "house-like" idea with station built in 1957 . . . with good results.

Upsy daisy — In routine extension of distribution mains and services, fill dirt sometimes must be transferred from one area to another. Laclede has found that tractor with high-lift scoop speeds backfilling operations.

IN ST. LOUIS . . .

Laclede Gas Distribution System Expands

Busy digging while the sun shines, Laclede has construction well underway—ready to meet the challenge of another larger-than-ever peak demand season. An unusual 12th major "take point" (regulator station), recently installed, looks like a modern, ranch-style home. In addition to replacement and additions to mains and service lines, that make up the heart of the distribution system, this year's construction program includes two notable extensions, involving large diameter main, on the western edge of Laclede's area. One, a 5.3-mile stretch of 20-in. line brings gas from northern end of system south along Lindbergh to vicinity Olive Street Road, connecting with and reinforcing an existing line there. The other, a 6-mile 16-in. feeder pressure line extending west along Manchester Road from east of Lindbergh to Highway 141 will supply suburban communities of Manchester, Winchester, Ballwin, and (eventually) Ellisville.

Trenching for the new Manchester feeder pressure line, Laclede construction crews rely on trenching machine, but use hand labor where crossings of existing supply lines are involved (foreground).

Frequent under-the-street boring was necessary on the Lindbergh Street extension. Here crew makes bore under access pavement to filling station.

At Catalan Street propane tank farm for peak shaving, work is proceeding on loading dock for propane trucks in background. Part of Laclede's agreement with Phillips Petroleum was that, in exchange for leasing these facilities, Laclede takes propane by pipeline.

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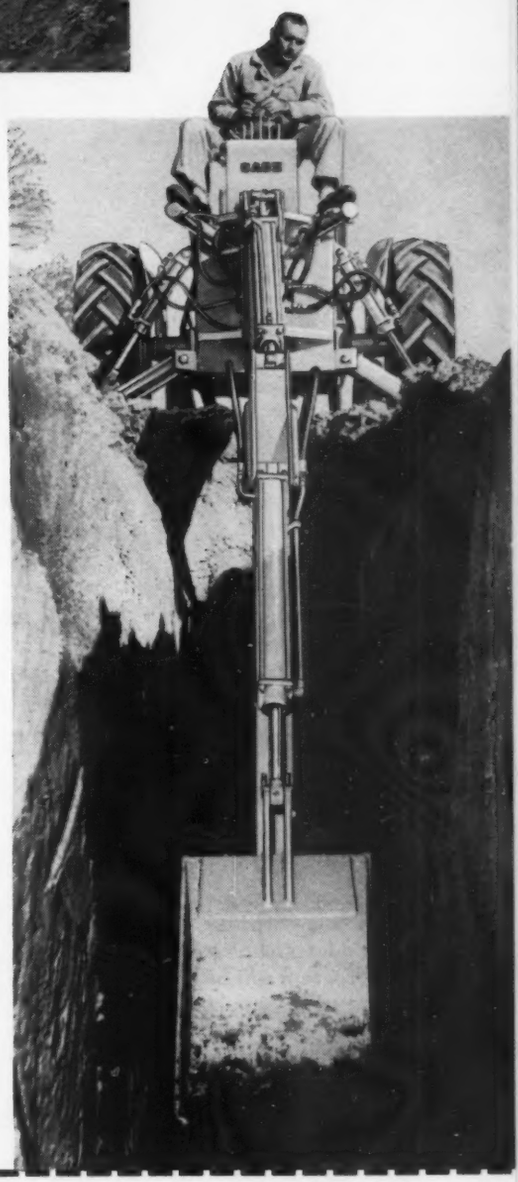

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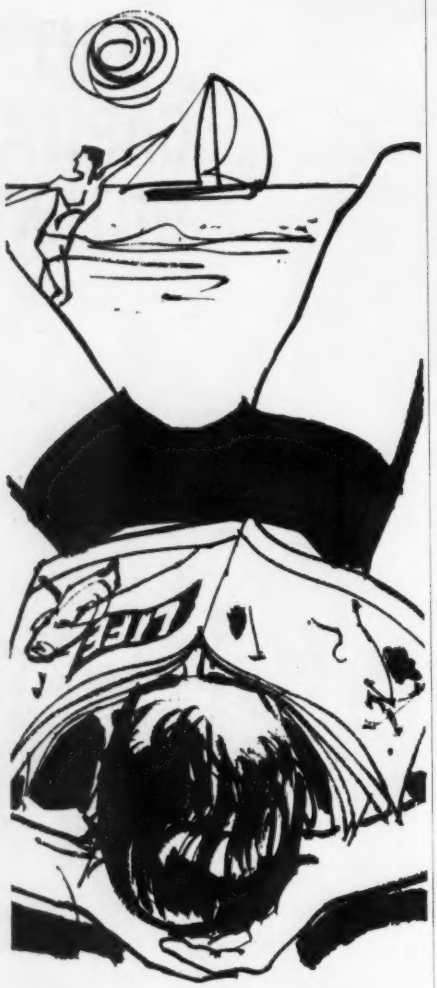

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Distribution Developments

Northern States Power Company, Minneapolis, Minnesota, is going ahead with its plans to supply natural gas in La Crosse and nearby communities, in connection with Northern Natural Gas Company's new transmission line to the area. NSP's construction costs which will include conversion and new installations to serve more than 12,000 customers in the area are estimated at $3,286,607. Construction of new mains and services is underway in Winona, and natural gas is expected this month from line to be built to the city from La Crosse by Northern Natural.

Company has just received North Dakota State Public Service Commission approval to provide natural gas service to Southwest Fargo and West Fargo; construction of facilities this year is expected to cost $107,600 with other construction required within the next three years estimated at another $117,000. Case was given "hurry-up" in order to make it possible for the two communities to receive natural gas this fall. Gas is to be supplied from a feeder line from Fargo. Natural gas to be available from Midwestern Gas Transmission Co. to Northern States on October 1 instead of November 1 as previously anticipated.

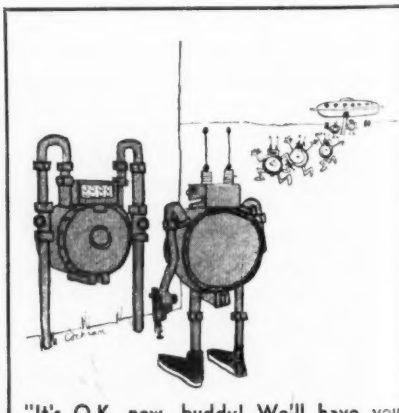
Northwest Natural Gas Company, Portland, Oregon, has plans underway to build two more city gate stations — Fairview and Carver — to bring more gas into the Portland metropolitan area. Gas turn-on ceremonies for Eugene and Springfield were held Sept. 12 with completion of the city gate station 3 miles north of Eugene and tie-in connections with El Paso's new transmission line. Northwest Natural is spending approximately $3,000,000 for inter-connecting mains, gate stations, and other facilities along the El Paso line to receive and market the new supply of gas. In addition to Eugene, there are gate stations at Salem, and mid-way between Albany and Lebanon.

Atlanta Gas Light Company, Atlanta, Georgia, is spending approximately $1,500,000, in addition to normal maintenance work and service extensions, for belt line improvements in Atlanta. Projects include 26,000 ft of 12-in. line to reinforce capacity in the northern section of Atlanta. Line runs from Clairmont and Peachtree along Peachtree-Dunwoody and Johnson Ferry roads toward Sandy Springs. A series of regulator stations are also being installed in the Rainbow Drive area in south DeKalb County to permit use of higher pressures on the existing line. Another project involves installation of 28,000 ft of 24-in. line; work is underway and expected to be complete by the middle of November. Latex Construction Co. of Atlanta is the contractor.

Cascade Natural Gas Corporation, Seattle, Washington, has construction underway to bring natural gas service to Richland, Washington. Planned is a 7-mile supply line of 4 and 6-in. from Richland to Kennewick where it will connect with El Paso Natural Gas' transmission line. (El Paso's phase of the project still pending FPC approval.) The natural gas distribution system in Richland will include 27,525 ft of 8-in.; 10,560 ft of 6-in.; 38,288 ft of 4-in.; and 9,175 ft of 2-in. Total cost is estimated at $367,752 the third year. Construction is also underway on new distribution systems in Union Gap, and the town of Selah, Washington. Other areas marked for future expansion are Bend, Oregon, Shelton, Bremerton, and Grays Harbor in Washington.

Delaware Power & Light Company, Wilmington, Delaware, is spending approximately $1,888,000 this year for construction of new mains and services in Wilmington and northern New Castle County. Estimated 90% of the work will be done in the high pressure gas system. Approximately 218,000 ft of 1¼ to 8-in. pipe will be installed for new business mains; 185,000 ft of ¾ and 1¼-in. for new services; 39,000 ft of ¾ and 1¼-in. for service renewals, and 61,000 ft of 1¼ to 12-in. for main renewals and work in advance of paving.

The Gas Service Company, Kansas City, Missouri, plans to build a new distribution system in the town of Ozark, Missouri, 19 miles south of Springfield on U. S. highway 65 at the junction of state highway 14. Company secured a 20-year natural gas franchise in city election August 9. Gas would be supplied from Cities Service Gas Co. pending FPC approval.



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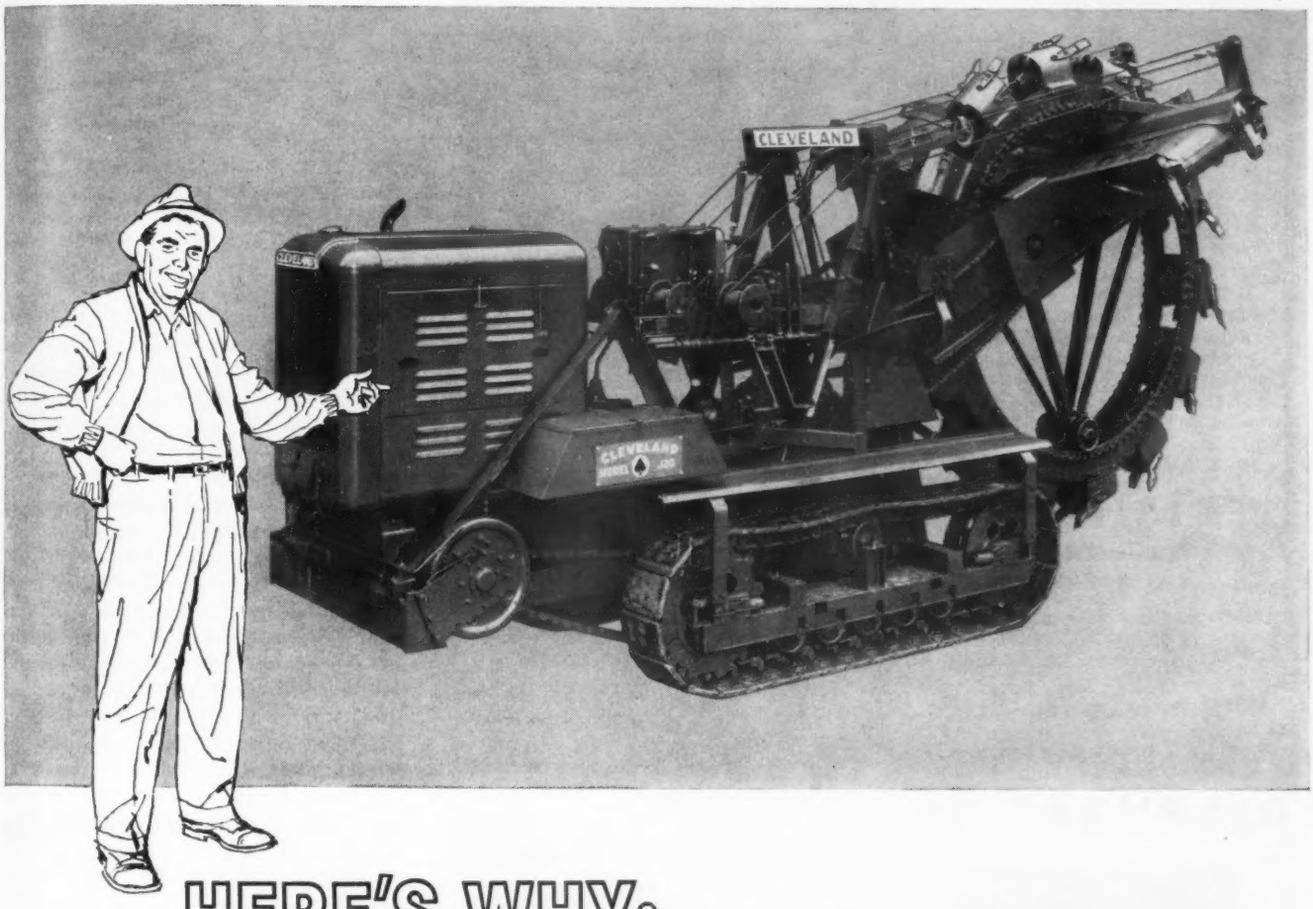

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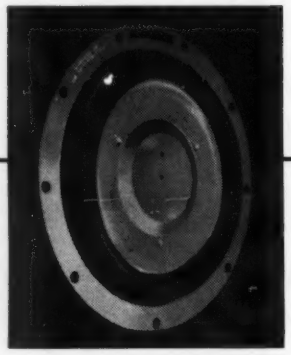

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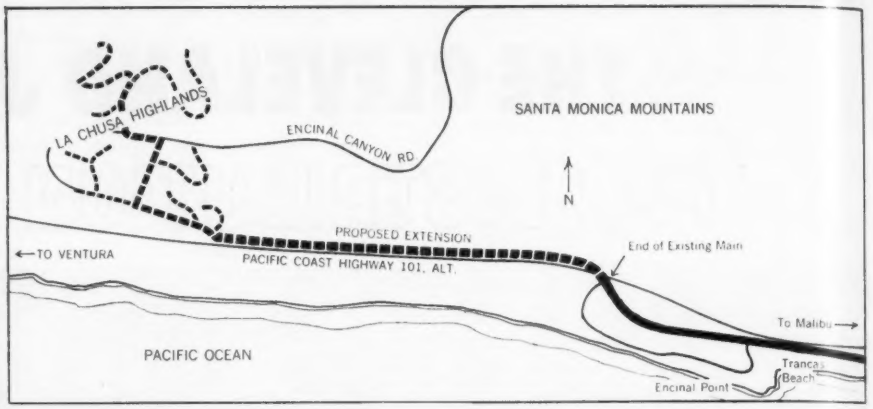

Southern Counties Gas Company is seeking California PUC authority to extend company lines from present western terminus near Trancas Beach northwest of Malibu in Santa Monica Bay division, to serve the development known as La Chusa Highland. Project involves approximately 17,900 ft of 6-in. at an estimated cost of $76,000; route of new main extension would be east along U. S. Highway 101 Alternate.

The Housatonic Public Service Company, Derby, Connecticut, plans to spend approximately $100,000 this year to extend gas mains in Newtown. Of this total, $97,000 is being spent for a 2.5 mile 8-in. gas main extension through the Elmwood district into the Dodgingtown district. The new line runs from an existing main at Milwaukee Avenue and Route 58, along Route 202 to Taunton Hill Road in Newtown; construction is underway. Another project involves extension of a branch line slightly less than a mile off Route 202 to serve the Stone Gate Park housing development on Old Hawleyville Road. Ultimately the 8-in. main will be extended all along Route 202 up to Main Street in Newtown.

British Columbia Electric Company, Vancouver, B.C., Canada, plans to add approximately 16,000 house heating customers and 6 "interruptible" industrial customers during 1960. Construction is currently underway on a 30-in. line to supply the Lower Fraser Valley and Greater Vancouver. Approximately $6,000,000 will be spent this year to install 18 miles of line between Huntingdon and a regulartor station on Livingstone Road about a mile east of Langley City. In 1962, the line will be extended to Fort Langley, and then west to tie into the gas system in Surrey. The new line (10 miles of 20-in.) will also supply gas to the Burrard Thermal Electric Generating Station now under construction on the North Shore of Burrard inlet near Port Moody. Another 6.5 miles of 20-in. will be installed in 1960 from an existing line near a pressure reduction station on Como Lake Road in Coquitlam, around the east end of Burrard inlet to the electric generating plant. In 1962, another 3.5 miles of 20-in. will be installed across the Fraser River at Port Mann, linking the new 30-in. line with the Coquitlam gas terminal. Approximately $7,000,000 has been budgeted for 1960 to extend distribution mains and install services throughout the Lower Mainland.

Wisconsin Fuel and Light Company, Manitowoc, Wisconsin, has obtained approval from Public Service Commission on its 4-year, $1,036,088 manufactured gas conversion plan in and near the area of Wausau. As the result of the recent FPC approval of the Michigan-Wisconsin Pipe Line expansion, Wisconsin Fuel plans to install a $169,836 distribution system and lateral in Mosinee.

Washington Gas Light Company, Washington, D. C., plans to spend $3,830,000 to construct approximately 16 miles of mains in the Washington metropolitan area. Project includes 15.8 miles of 24-in. from Hybla Valley, near Alexandria, Virginia, across the Potomac River into Prince Georges County, Maryland, to a connection with an existing line near the District of Columbia border; approximately 0.3 of a mile of 16-in. to connect two existing lines and replace an existing connecting line that must be abandoned because of road construction.

San Diego Gas & Electric Company, San Diego, California, has construction underway on a 50-mile 30-in. gas transmission line from Rainbow meter station to San Diego. Completion date is set for November. New line will boost system capacity to 345,000,000 cu ft per day, virtually double present capacity of the company's two existing pipelines—the 12-in. Huntington Beach line, and the 16-in. Moreno line. Contractor is Stanley-Bledsoe Corporation of Tulsa, Oklahoma.

Developments

Wisconsin Southern Gas Company, Lake Geneva, Wisconsin, plans to spend $533,400 in 1960 on new construction. Approximately $88,500 has been tabbed for main replacements; $50,000 for enlarging main capacity in the Burlington-Delavan area; and $66,200 for relocating mains on the highway west of Lake Geneva. Other budget items are $125,000 for service line installation; $34,000 for meter regulator facilities; $20,000 for tools and work equipment, and $23,000 for vehicle replacements.

As a result of the recent FPC "okay" of Michigan-Wisconsin Pipe Line Co. expansion, Wisconsin Southern will install facilities for distribution of natural gas in Sharon and Clinton, Wisconsin, at an estimated cost of $315,837.

Iowa-Illinois Gas & Electric Co., Davenport, Iowa, has construction underway on approximately 20 miles of ⅜ to 6-in. gas distribution lines in and near the cities of Rock Island and Moline, Illinois. Universal Pipeline Construction, Inc., Kansas City, Missouri, is contractor.

Illinois Power Company, Decatur, Illinois, has construction underway on a 75-mile ¾ to 4-in. natural gas city distribution system along Highway No. 50 north of Belleville, Illinois. Contractor is Universal Pipeline Construction, Inc., Kansas City, Missouri.

Long Island Lighting Company, Mineola, New York, has construction underway on 12 miles of 16-in. gas main from Commack to Centereach in Suffolk County. An extension of LILCO's "backbone" supply which begins at Garden City, the new main will serve approximately 4000 space heating customers in the area extending from Huntington to Brookhaven. On the basis of 1959 orders, it is anticipated that load growth will be at least 20 percent per year.

City of St. Petersburg, Florida, has contractor crews installing 30,000 ft of 4, 6, and 8-in. gas lines. Completion date is set for September; Mims Pipeline Construction Co., Inc. of Louisville, Kentucky, is contractor on the project.

Village of Stonington, Illinois, plans to build a municipally owned gas distribution system estimated to cost $240,000. Village has FPC examiner Kelly okay, but decision is still subject to review by FPC. Panhandle Eastern Pipe Line Co., the supplier, would deliver a maximum of 572,000 cu ft daily to the village.

Multiple-duty **PAYLOADER**®

...with Side-boom and Bucket

This "PAYLOADER" tractor-shovel, equipped with hydraulic side-boom, is helping to re-lay 1800 ft. of 6-in. gas line two feet deeper to accommodate new street construction. It handles the pipe, backfills and levels off. The same "PAYLOADER" could, in addition, have an hydraulic back-hoe on the rear, and a Drott "4-in-1" clam-shell-type bucket in place of regular bucket on the front.

Usefulness unlimited. These three attachments — side-boom, back-hoe and "4-in-1" bucket — on a single "PAYLOADER", and available only on a "PAYLOADER", give you a one-man equipment fleet for pipe line construction and maintenance. Combined with the traction and mobility of 4-wheel-drive, they can get anywhere quickly and do almost any kind of lifting, trenching, and earth or materials handling work that may be needed.

A size for any need. 4-wheel-drive "PAYLOADER" units are available in 5 sizes up to 12,000 lb. operating capacity. A nearby Hough Distributor with complete service and parts facilities is ready to help select the model and attachments that best fit your needs.

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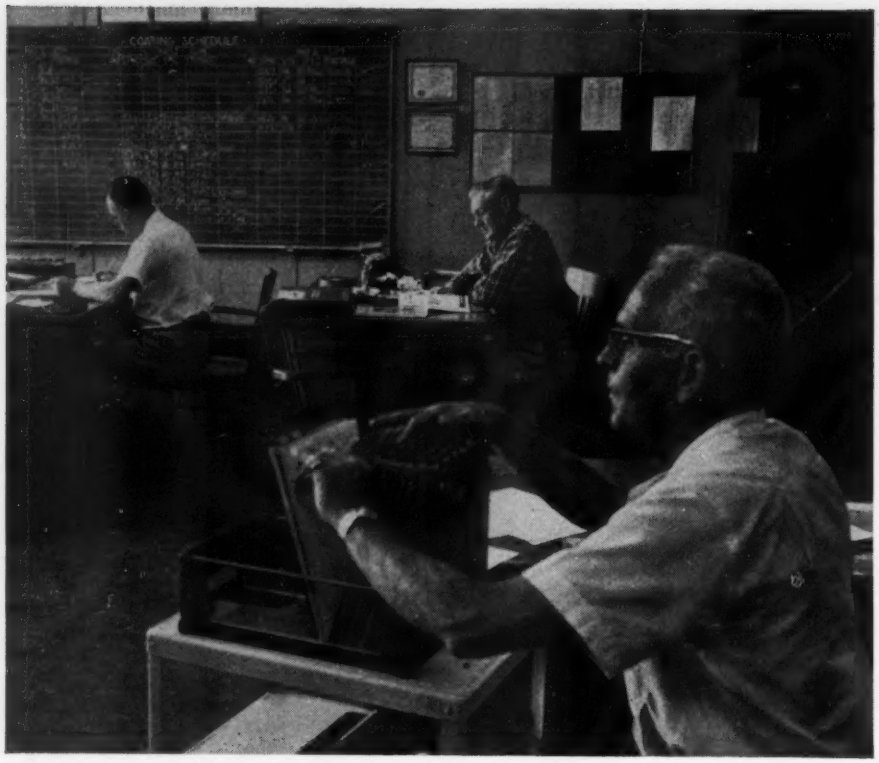
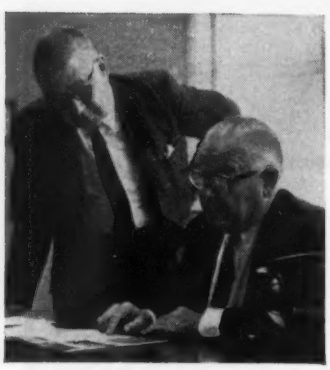


Control Board of coating and wrapping schedules in the Plant Office.

Working for You at spi



President Baird checks on final shipment.

All these people and many others, each skillfully trained for his particular job, are working on your pipe. Each one is seeing to it that your pipe is coated and wrapped precisely to your specifications, and that it is shipped at the exact time and to the exact place that you have requested.

Efficient office force keeps adequate records to prevent any error in filling your order.

V.P. Wilson discusses plans with V.P. Vondrasek.

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BOOKSHELF

Welcome reference . . .

"Gas Rate Fundamentals," first thorough book on gas utility rate fundamentals and practices, has been prepared by A.G.A.'s Rate Committee. Intended primarily for on-the-job training of gas company employees and new men in rate departments, it is also a valuable reference for the seasoned veteran. Each of the book's seven major sections is supplemented by a bibliography to aid in additional research or study if necessary. Major subjects include state and local regulation of public utilities, court and commission decisions influencing rate regulations, analysis and determination of utility costs and rates, load forecasting, and preparation and presentation of rate cases before regulatory groups. A brief history of the gas industry covered in section 1 traces industry development from manufactured gas, the transition of natural gas, through the growth of natural gas pipeline companies. Economics of gas production are briefly investigated. Section 2 pinpoints early beginnings of regulation of public utilities, development of commission regulations, and the entrance of federal regulation.

You won't want to miss this one—it's available from the *American Gas Association, 420 Lexington Avenue, New York 17, N. Y., for $7.*

Engineer's Vest-Pocket Book. *Published by Ottenheimer Publishers, Inc., 4805 Nelson Avenue, Baltimore 15, Maryland. Pages, 192. Price, $.90.*

Wealth of engineering information on mathematics, building, mechanics, heat hydraulics, pipes, electricity, surveying, costing, mining, chemistry, and miscellaneous data. Includes alphabetical index, and index of 47 charts and tables. Everything from formula for binomial theorem, properties of saturated and superheated steam, to thermal stress, and cost estimating . . . in compact form (2⅝ by 5½).

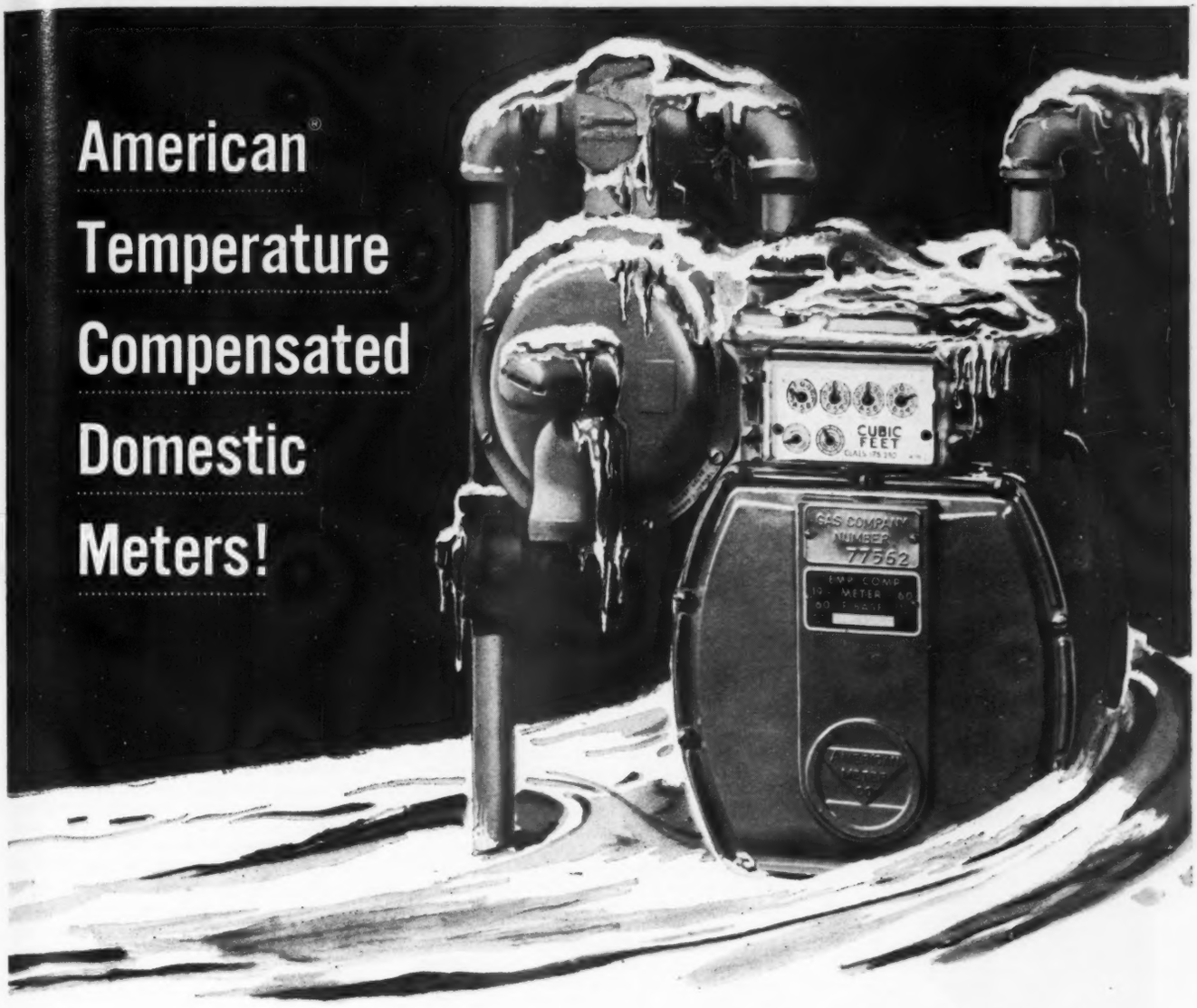
Pressure Vessel and Piping Design. *Published by American Society of Mechanical Engineers, 29 West 39th Street, New York 18, New York. Pages, 700. Price, $10.*

Book was compiled by committee of experts in the field who searched a vast number of technical papers and reports published between 1927 and 1959 and selected key writings for inclusion in the book. Ten sections deal with openings, bolted-flanged joints, heads, shells, piping, materials and fabrication, thermal stress and fatigue, loads and supports, external pressure and miscellaneous topics. Helpful to designers . . . but book should not be construed as supplemental requirement to *ASME Boiler and Pressure Vessel Code.*

Soldering Manual. *Published by American Welding Society, 33 West 39th Street, New York 18, New York. Pages, 176. Price, $5.*

First manual on soldering ever published covers principles of soldering, as well as describing latest techniques of what, when, and how to solder. Equally useful to amateur and professional, manual gives details on solders, fluxes, joint design, precleaning, and surface preparation, inspection and testing, copper and copper alloys, steel, coated steels, aluminum and aluminum alloys, cast irons, etc.

Now, from the pioneers in temperature compensation...



Once again, American Meter Company research has made a tremendous contribution to the technological progress of the entire Gas Industry. Like every other American Meter advance, the Temperature Compensating Domestic Meters are an outgrowth of the Company's continuous search for *better* ways to serve the industry's needs. In fact, nearly 30 years have passed since American Meter introduced the first temperature compensating device for large Positive Displacement Meters—the Base Volume Index.

The new Temperature Compensator is continuing proof that the Gas Industry can count on American to develop the most modern, accurate measurement equipment. American has pioneered in meter progress since 1836—and will continue to bring progress through research!

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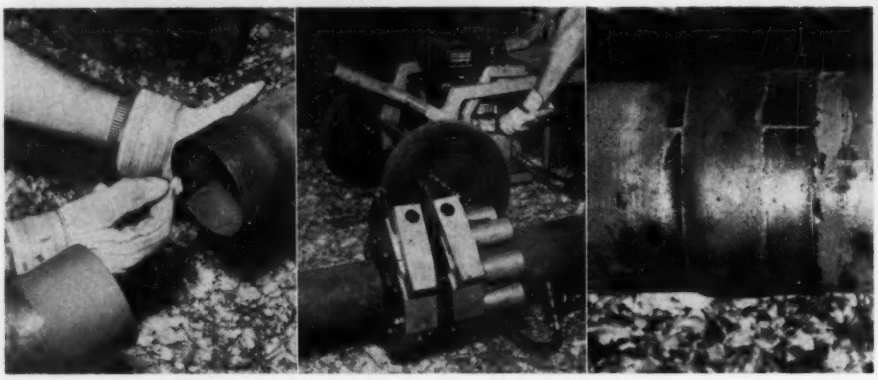
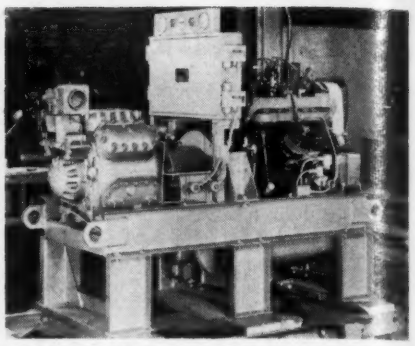
PRODUCT PARADE

MATERIALS – EQUIPMENT – SERVICES



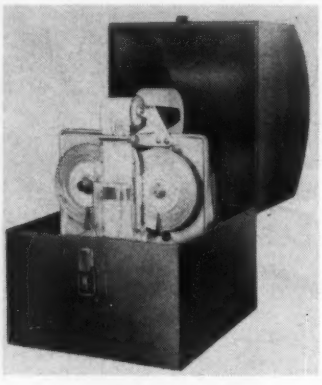
Rapid, low-cost method of joining steel pipe with epoxy adhesive . . . provides a plastic-lined joint that prevents internal joint corrosion, reduces material costs and installation time, and eliminates welding operations. New development, field tested for past year, uses a new bell-joint steel pipe, epoxy glue, and a simple crimping tool. Female end of each pipe length is flared to a bell shape to receive male end of another length. Special epoxy glue is applied to mating surfaces prior to joining. Tool crimps joint to hold it firmly together while epoxy adhesive sets. Pipe costs on recent epoxy-joined installation, using light wall pipe, are said to be 58% lower than cost of conventional pipe, installation costs were reduced 25%, and installation time was one-half of that required for welded-joint pipe.

CIRCLE (1) ON THE REPLY CARD



Gas-engine driven air conditioning and refrigeration units . . . have been announced by Bell & Gossett Company. Firm now offers three basic units for industrial and commercial use . . . package liquid cooler unit for water cooling systems, refrigeration condensing unit series, and an engine-compressor unit. All component equipment, except gas-fueled engine, is manufactured by the firm. *Refrigeration condensing unit series,* including 12 units ranging in capacity from 7½ to 150 tons. *New engine-compressor unit* has infinite modulation range — from 1800 to 1200 rpm — and lubrication supply good for 2000 hours, a full season's operation without refilling.

CIRCLE (2) ON THE REPLY CARD



Gas survey recorder . . . can be used in conjunction with conventional gas meter for time-demand studies. Recorder produces a punched-tape record of gas demand that can be automatically translated to punched cards or computer tape for computer studies. Unit can be coupled to any gas meter by means of a contact-making device within the meter, which operates once for every 10 cu ft of gas or other designated amount. Recorder maintains a running total of gas consumption and records total on a binary-coded paper tape ever 15, 30, or 60 minutes. After period of unattended operation, tape can be removed and converted to punched cards, computer tape, or typewritten form on a translator unit, eliminating manual handling of data. Unit is available as a portable model, powered by a 7.5-v. dry cell battery, said to last for one year at 15-min readout intervals. Portable unit, encased in sturdy steel weather-proof case hinged or easy accessibility, weighs only 40 lb. Unit also holds a year's supply of tape.

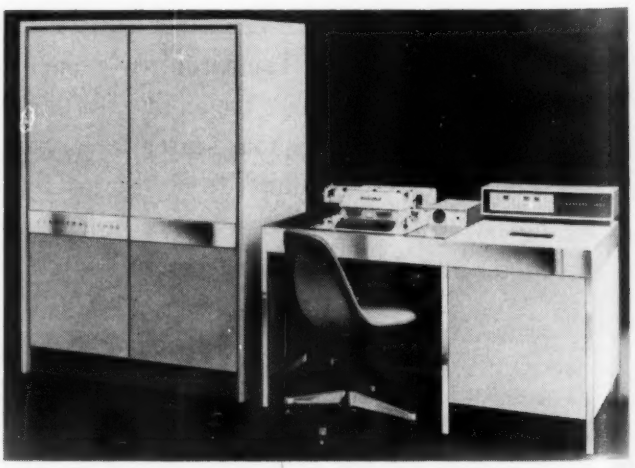
CIRCLE (3) ON THE REPLY CARD

New computer for gas dispatching control applications . . . Completely transistorized, advanced process control digital computer system capable of accepting data directly from analog instrumentation and providing for closed-loop operation, the LIBRATROL-1000 has been announced by the Librascope Division of General Precision, Inc. New unit includes an advanced memory unit new developments in read and write head design, and a built-in voltage-to-digital converter.

Departures from conventional design approaches include a drum memory with advanced physical characteristics and higher levels of memory reliability. The LIBRATROL-1000 operates in the serial, binary mode and offers expanded data-handling capabilities . . . has an 8000-word memory and a new concept in data placement and recovery.

Unit is designed to exercise control over processes (such as telemetering flow, temperature, and pressure data from remote points and making control adjustments at delivery points) . . . and between control cycles the unit analyzes other complex process operations and makes statistical evaluations of the process parameters. From such analysis, future control criteria are established.

The two-address unit accepts 32 basic instructions; magnetic memory drum accommodates 24 special instructions; has buffer memory of 64 words; word length is 31 bits plus sign; clock frequency is 120-kc; has add time of 0.25-millisecond and multiply time of 16.5-millisecond (excluding access time); an internal, binary real-time clock, and mercury relay analog input switching.



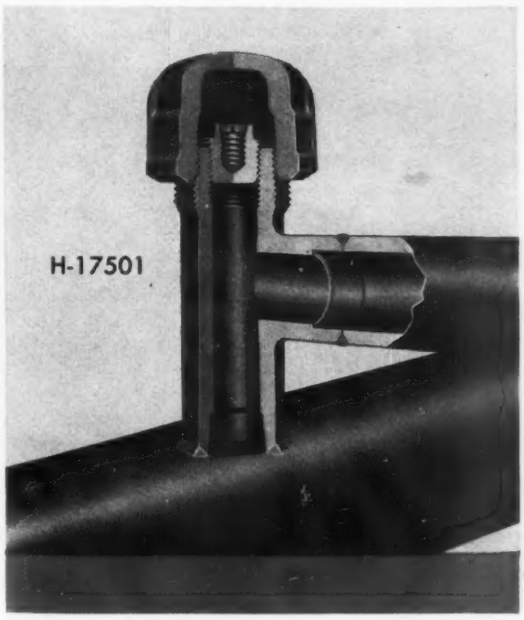
Computer weighs approximately 1200 lb, measures 48-in. wide by 28-in. deep by 72-in. high, has self-contained refrigerations system in main cabinet to maintain constant temperature and atmosphere of electronic equipment. All computing elements except input-output devices are sealed in an air-tight enclosure.

CIRCLE (4) ON THE REPLY CARD

There is absolutely no blowing of gas to the atmosphere when you install a MUELLER® NO-BLO® Service Tee.

Double pressure seal at top prevents leaks...

even at 1,200 p.s.i. working pressures!



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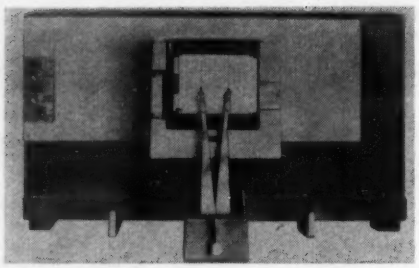


New chart integrator for use with American Meter Co. strip charts and conventional instrument round charts provides three values from a single run — it computes chart extension for differential and static pressure, and provides read-out values for average absolute static pressure and average differential pressure. Integrator handles both strip charts and conventional round charts by means of a simple adaptor plate supplied with the instrument.

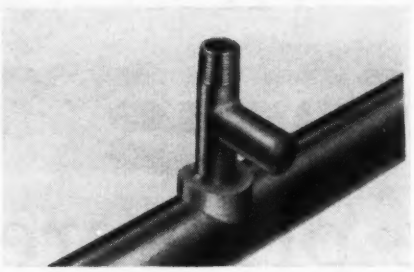
CIRCLE (6) ON THE REPLY CARD

Industrial and commercial incineration portfolio, available from the A.G.A. includes complete outline of incinerator data and other material to equip utility salesman with necessary sales tools, information and background material to make an intelligent presentation. Points out broad market possibilities, need for incinerators, steps to take in preparing oral or written presentation, and how to select proper equipment. Several suggestions are included for dealing with municipal authorities on codes and regulations and for approaching air pollution officials for permits.

CIRCLE (7) ON THE REPLY CARD

New epoxy pipe coating recently announced by Dearborn Chemical Co., has a rapid curing rate, exceptional resistance to physical impact, abrasion, and moisture adsorption. Provides superior protection against chemical attack, and high electrical resistance. It retains physical properties over a temperature range of minus 40 F to 250 F plus. Coating, composed of two components, is blended at point of application. Can be applied with a brush, roller, or airless-type spray equipment.

CIRCLE (8) ON THE REPLY CARD



Punch tee . . . Latest addition to Thermotap line of service connections is a high-strength cast steel punch tee with a ¾-in. base. Outlets can be ¾ or 1-in. male pipe, threaded or smooth for compression coupling or welding. After Thermotap connection has been made, hardened ⅜-in. punch is screwed into tee until pipe is pierced; then unscrewed. Punch can be used as a shut-off valve by rescrewing until it seats in hole pierced in main. Punch tees are tin plated and beveled especially for thermotap process, or can be supplied plain for gas or arc welding.

CIRCLE (9) ON THE REPLY CARD

PRODUCT

Portable communications . . . Latest addition to Seiscor's Telepath portable communications line provides intelligible communications under any noise conditions by utilizing transistorized amplifiers in combination with variety of earphone-microphone headsets. Units are adaptable for almost any type operation requiring wired person-to-person communications. Lightweight amplifiers clip to the belt and provide unique volume control so user can choose most comfortable voice level.

CIRCLE (10) ON THE REPLY CARD

Industrial combustion equipment . . . including every type of burner, mixer, pilot, regulator, blower, valve and accessory manufactured by Bryant Industrial Products Corp. . . . is described in new 8-page condensed catalog. Data given on size range, capacity, and application of more than 55 types of products.

CIRCLE (11) ON THE REPLY CARD

Extra Heavy All-Malleable COUPLING

Engineered for latest distribution pressures and for installation ease. Inspect its construction and quality materials in detail.

Provides More Deflection Than Ever

Top Quality for 22 Years in Gas Distribution Equipment

Get helpful CATALOG 29. Photos, specs, detail drawings & much helpful data for modernizing or new installations.

PERMANENCY Rely on NORTON-McMURRAY for the finest! NORMAC continues to modernize and improve couplings and fittings in step with latest gas distribution demands. 22 years experience concentrated on ONE purpose . . . the BEST! Today, major gas distribution companies say "NORMAC" to define their standard of quality.

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EARTH-BORES HORIZONTALLY . . . SWIFTLY

UP TO 250' OF 2" TO 24" OPEN HOLE FOR PIPE INSTALLATION OR SOIL DRAINAGE

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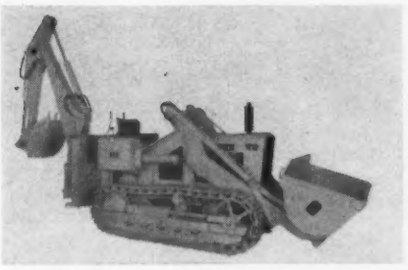
Regulator . . . Patented velocity baffle and new sensitive Reevecote fabric diaphragm have helped perfect accuracy of Bryant zero regulator used in combustion control systems and prepared atmosphere systems where precise flow control is essential. Regulator automatically holds constant outlet pressure to within plus or minus 0.1-in. w. c. at all flow rates. At increased capacities, baffle prevents usual drop in outlet pressures, and instead pressure rises slightly above a set point, thereby compensating for velocity pressure losses in downstream lines. Sensitive diaphragm material, strong enough to withstand high emergency pressure and immune to all types of gases, was selected to allow regulator to function with very narrow range of plus or minus 0.1-in. w. .c

CIRCLE (12) ON THE REPLY CARD

ADRAC . . . Computer Systems' completely transistorized, plug-in Automatic Digital Recording and Control System can, without human help and via punched tape, select a computer, place it into operation, set computer elements, read back variables to check computer settings, and then initiate problem solution. Also during the operation, unit prepares a typed record of all controls, addresses, voltages, references, unsuccessful verifications, and out-of-tolerance comparisons. Although designed for monitoring and controlling up to 10 analog computers of 10,000 inputs each, ADRAC unit can be used independently wherever data logging, reduction, and control are required.

CIRCLE (13) ON THE REPLY CARD

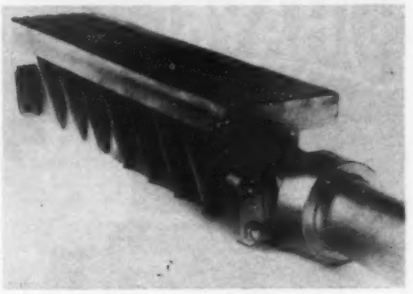


John Deere's new line of tractors will include the largest range of power sizes the company has ever offered, — two crawler tractors in the 40 and 50 engine hp sizes; 4 wheel tractors of 40, 50, 60, and 85 engine hp. All tractors have power matched equipment and will feature new John Deere-built variable speed engines. Attachments for this new series includes backhoes, loaders, bulldozers, mowers, and specialized tools. Single lever on the crawler-loader units controls all movements of both loader lift arms and the bucket. On both crawler units a new T-bar control for all-hydraulic bulldozers commands all 4 operation functions — angle, tilt, lift, and cut.

CIRCLE (14) ON THE REPLY CARD

"They're like gas appliances . . . they can be seen in all the best places."

First adjustable gas-fired infra-red burner available is Bryant Industrial Products' new burner for low-temperature industrial processing applications. Outstanding characteristic of the new burner is maximum



radiation intensity at minimum fuel input. Every material has a maximum heat absorption wavelength; most are concentrated in the 2.0 to 4.0 micron band — the wavelength at which the new infra-red burner provides radiant heat emission. Face temperature of the burner screen is 1200 to 1800 F; nominal heat output is 30,000 Btu per hour per unit. Burner utilizes standard Bryant mixer, pressure regulators, and pilots.

CIRCLE (15) ON THE REPLY CARD

Combustion safeguards . . . are described in new bulletin from Selas Corporation. Both assembled and exposed views of compact "Firecheck" and new design 8-in. safety "blowout" are given. Drawings, dimension data, piping diagrams, and principles of operation are included along with listings of auxiliary equipment and combustion accessories.

CIRCLE (16) ON THE REPLY CARD

The MINIATURIZED-PRECISION WILKINSON Line Locator Model W-3

This radically new, super-powered, transistorized instrument weighs only four pounds and is one-fourth the size of conventional pipe locators.

It's as handy as a flashlight; the maintenance is trivial; the non-leak miniature batteries last ten times longer. Long-life transistors eliminate replacement. Molded glass fibre cases. Transistor ear set. Telescopic handle. Etches circuitry. Contained in carrying case.

WILKINSON PRODUCTS COMPANY

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GOODMAN GAS MAIN STOPPER

Used since 1897

Improved Locking Sleeve

PIPE STOPPERS OF ALL KINDS

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SAFETY GAS MAIN STOPPER CO. INC.

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Low, Medium and High Pressure

METER SETTINGS
Flat Head • With or Less Check
Lock Wing

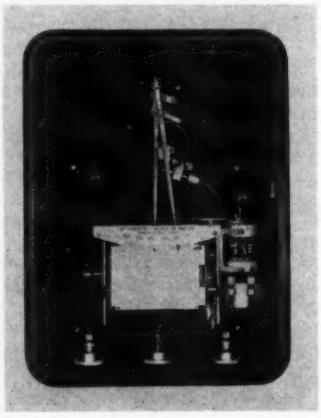
INDUSTRIAL USE
Three-Way • Graduated Dial

APPLIANCES and EQUIPMENT
Lever Handle • Square Head
Flat Head
A.G.A. Listed Control Valves

GENERAL PRODUCTS DIVISION
HAYS MFG. CO.
ERIE, PA.

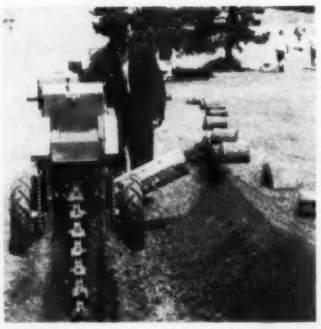
Aerosol-packaged pipeline primer eliminates need for spray equipment, pots, and brushes. Freon pressurizing assures can is emptied to last drop, without waste or spillage. Totally safe, new dispenser carries seal of approval of New York Fire Department.

CIRCLE (17) ON THE REPLY CARD



New strip chart recorder provides a record of flow, pressure, and temperature measurement for periods up to 36 days without attention. Reduces chart changing costs as instrument is cartridge type and each cartridge, including chart, storage spool, and rewind spool, is removed as a unit. Requires no re-threading at the site. Cartridge fits into American chart integrator for fast chart interpretation. Has a chart capacity of 38 ft; chart speeds are available from one-half to 6 inches per hour, powered by either an electric drive or an American Gasclok power drive. Recorder can be used with instruments equipped with 3 pens for flow, pressure, and temperature, for use in orifice meters, pressure or temperature recorders, integrating orifice meters, or with telecounter transmitters or telemeter receivers.

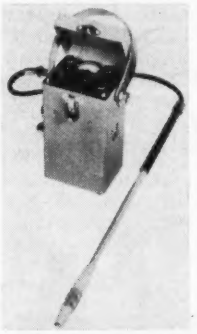
CIRCLE (18) ON THE REPLY CARD



Self-propelled trencher . . . Arps' newest Trench-Devil weighs only 1460 lb, can dig 4, 6, 8, 10 or 12-in. trench to depths of 2½, 3½, 4½, or 5½ ft. Powered by an air-cooled 12-hp heavy-duty engine, it is only machine in its power class capable of digging 5½ ft deep and 8-in. wide or 4-ft deep and 12-in. wide. Digging speeds vary from 0 to 1200 ft per hour in forward or reverse. Heavy-duty, rubber-belted conveyor deposits dirt on either side of trench without power loss or side thrust, insuring positive, straight line trenching. Conveyor can be detached and installed from one side to the other.

CIRCLE (19) ON THE REPLY CARD

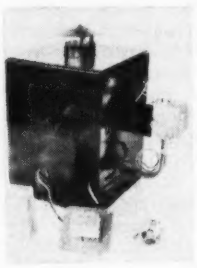
Portable probe type gas detector, available from Houston Instrument Corp., is



calibrated in percent of lower explosion limit. Reference chart in the lid gives absolute value of percent gas in air; single control allows immediate zeroing for quick indication. Probe tip need only be inserted in or around suspected area — no elaborate procedures or sampling systems are required. Meter is normally calibrated for methane or ethane; however, it can be calibrated for lower explosive limit of any gas desired. Unit weighs only 8 lb.

CIRCLE (20) ON THE REPLY CARD

Gas-fired humidifier . . . produced by Southern Manufacturing Engineers . . . features stainless steel vaporizing chamber, safety pilot, low voltage wiring, fan interlocking, hermetic float control, humidistat and limit control. Can be installed in 2 hours on any forced air heating system, vaporizes 5 lb of water, and uses 7 cu ft of gas per hour.



CIRCLE (21) ON THE REPLY CARD

New insulating union outlet now offered on Mueller LubOseal and Tamperproof gas meter stops will not leak under even most adverse conditions . . . provides practical, easy-to-install method of isolating service lines from house piping. Two completely separate elements seal and insulate new union. Yet, both are component parts of stop body and union tailpiece . . . there are no loose washers or gaskets.

CIRCLE (22) ON THE REPLY CARD

Non-metallic pipe marker posts and signs for road and railroad crossings of distribution lines . . . are made of tough resin-rubber compound (ABS polymer). Developed by Handley Industries, the posts are rust proof and rot proof. Even gun shots won't shatter them. Never need painting because finish is chemically bonded in. Posts weigh 7½ lb, come packaged 5 to a container. May be equipped with side or top mounted signs, mounted vertically or horizontally with cathodic terminal cap, vent cap, or telephone tab.

CIRCLE (23) ON THE REPLY CARD

* * *

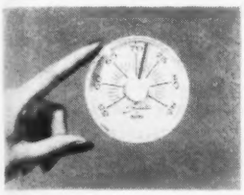
One of the frustrations of an elevator operator is that he never hears the end of stories.

PARADE

Low voltage wall thermostat . . . Controls Company of America's new electric wall thermostat for controlling gas heater temperatures between 55 and 85 degrees Fahrenheit is a two-wire, low-voltage horizontal thermostat of the heat-anticipating type. It uses single-pole single throw, bi-metal-actuated snap contact. Three basic parts are mounting bracket, base, and cover. Cover is secured to base by friction snap and can be easily removed. Two screws secure mounting bracket to wall and no leveling of device is necessary.

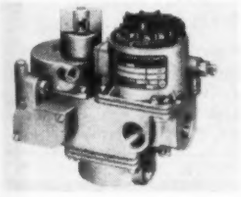
CIRCLE (24) ON THE REPLY CARD

Wall control . . . Maxitrol Co.'s new wall control for electronic modulation systems used on gas furnaces combines thermostat and selectrastat. Identical in appearance with the first selectrostat introduced last year, the new control has added a bi-metal thermostat that produces mechanical snap-action and magnetic spark blow-out. Selectrastat still features a tiny thermistor to sense 1/10 deg temperature variations.



CIRCLE (25) ON THE REPLY CARD

Automatic gas control valves . . . General Controls new "Versatrol" combination valve can be quickly adapted for many applications on forced-air furnaces, floor furnaces, room and wall heaters, appliances, and other gas-fired equipment up to 180,000 Btu capacity. Basic valve consists of main gas cock and manual reset 100% safety shutoff valve. To this basic valve, operators for main gas thermostatic control and pressure regulation may be added, removed, or interchanged to provide exact combination and operation desired. When changing from one type of gas to another, it is unnecessary to remove or replace entire valve assembly, just the operator. Three distinct types of add-on thermostatically controlled operators are available: self-energizing millivolt, 24/115 volt solenoid, or the silicone-filled silent hydranoid type.



CIRCLE (26) ON THE REPLY CARD

Datex's Gray-to-binary translator which may be operated either as a storage unit for data recording or controlled to continuously follow and translate encoder data is described in new 2-page bulletin available from Datex Corporation. Unit will translate up to 14 bits of gray code to binary (depending on options selected) with a maximum propagation time of 10 microseconds per bit.

CIRCLE (27) ON THE REPLY CARD

Portable two-way radio can be recharged using car's cigarette lighter or an electrical outlet. Key to the recharging is a built-in battery charger used with a 12-volt d-c vehicular system or 117 volt a-c. Rechargeable nickel cadmium power supply saves battery replacement costs and enables portable to be placed on constant charge on a shelf while awaiting use. Unit may be charged thousands of times without battery damage. General Electric's new unit contains an all-transistorized receiver and can be operated in the 25-54 mc and 144-174 mc frequencies, which means it can be used to transmit to existing vehicular two-way radios, to pocket units, or portable-to-portable.

CIRCLE (28) ON THE REPLY CARD

Steamboilerplants . . . automatic horizontal 3-pass scotch marine units manufactured by Eclipse Boiler Division . . . are described in 4-page illustrated bulletin. Design and construction features are explained, and specifications provided on 80, 100, 125, 150 and 200-hp gas-fired boilers for the 125 lb maximum working pressure.

CIRCLE (29) ON THE REPLY CARD

Safety film . . . produced by Construction Machinery Division of Clark Equipment Co. in cooperation with National Safety Council . . . depicts many of the accidents that happen on construction jobs and shows why they happen. Preventive steps that should have been taken are emphasized.

CIRCLE (30) ON THE REPLY CARD

STRAIGHT LINE PAN MOVEMENT

it's easy with this Improved Lancaster carrier wire assembly

2 NEW Lancaster FEATURES FOR INCREASING GAS METER ACCURACY

There's no chance for a diaphragm pan to start traveling in an arc when you install this improved Lancaster Carrier Wire Assembly.

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Oval slot center brackets available separately can be adapted to any carrier wire. Porous bronze and graphite bushings used throughout. Order now for easier installation and increased meter accuracy.

A meter is only as accurate as its parts . . . and Lancaster quality parts are guaranteed to outperform the original parts.

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PRODUCT PARADE

Chain wrenches . . . Two new models—one for use on up to 2-in. pipe and fittings, and the other for up to 2½-in. pipe and fittings—have been added to Ridge Tool Co.'s line of wrenches. Designed especially for work in extra tight quarters new units feature fast, ratchet-like action in either direction, from either side. Chain gives tight grip without crushing on all round, square, or irregular shapes.

CIRCLE (31) ON THE REPLY CARD

Fluorescent danger flags for street, highway and plant use are made of durable and long wearing vinyl permanently bonded to both sides of a nylon base fabric. Brilliant flame red, flags are offered in assortment of styles and sizes for use on sign and flag standards, barricades, traffic cones, and trucks and trailers.

CIRCLE (32) ON THE REPLY CARD

* * *

Sign in hotel equipped with sprinkler system: "Don't smoke in bed. You may drown yourself."

Multi-purpose industrial heating product . . . Lennox's new dual-fuel series is designed to be used either as a central furnace, a unit heater with directional discharge nozzles, or duct furnaces with performance capabilities for future addition of industrial air conditioning. New unit can be installed for up-flo, down-flo or horizontal delivery and is U. L. listed. Gas burner is of inshot type for natural, manufactured, mixed and LP-air mixtures. Btu per hour output on gas-fired units is 750,000 or 1,000,000.

CIRCLE (33) ON THE REPLY CARD

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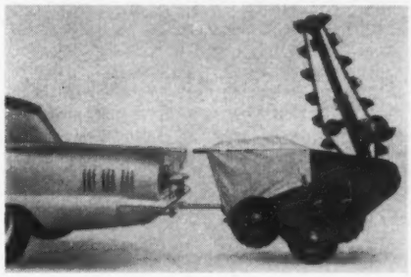
PRODUCT PARADE



"Compact" trencher . . . Compact car counterpart in the construction equipment field is new Auburn "compact" unit—a "big" self-propelled trencher in a small package. Trencher has a single unit body constructed of heavy steel plate, four-wheel drive, in both forward and reverse, powered by a hydraulic drive that automatically gives maximum trenching speeds under varying soil conditions, and a digging boom that lifts hydraulically through an arc of 186 deg. Transport wheels, that raise and lower, eliminate need for a separate trailer to haul the "compact"; trencher may be towed by any vehicle to job site. Cuts trenches 3, 4½, and 6-in. wide down to 5 ft deep at speeds of up to 500 ft per hour.

CIRCLE (34) ON THE REPLY CARD

Precision-jet gas burners . . . are described in 6-page bulletin from Barber Manufacturing Co. which lists Btu specifications and physical dimensions of 24 models of the impinged jet type and 24 models of the slotted cap jet design. Both are intended for high temperature applications.

CIRCLE (35) ON THE REPLY CARD

Transistorized counters . . . New series of transistorized counters from Datex Corp., employ digital logic techniques to register every input signal at rates up to 100 kc. Can be arranged to count either up or down to a predetermined number. Cumulative count may be either binary-decimal code or natural binary code. Output signals are in form of appropriate voltage levels. When used with system programmers and amplifiers, counters are suitable for operating telephone or mercury relays, tape punch solenoids, electric typewriters, and other output devices.

CIRCLE (36) ON THE REPLY CARD

REPRESENTATIVE WANTED

in your territory. From your desk you can earn a substantial addition to your income. Only written contracts with your clients! Write for particulars and further details to VKK-Office, Vienna 66, P. O. B. 128, Austria.

DISTRIBUTION RESEARCH ENGINEER WANTED

Challenging position available in organization and supervision of distribution research programs for the Industry. Graduate engineer, under 35 years of age, must have 5 to 10 years experience and excellent knowledge of all phases of distribution operations. Research experience with large gas utility preferred. *Please furnish resumé of education, experience and salary requirements to:*

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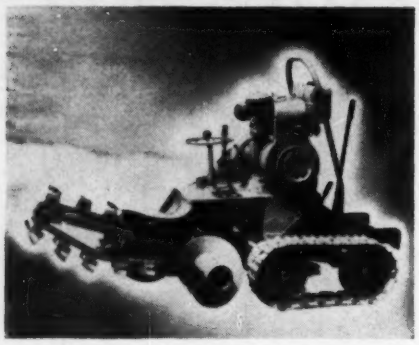
PRODUCT PARADE



Trencher acquires tracks . . . Ditch Witch trenchers in the M series can be converted to crawler-type with new adapter kit or purchased new in 9 or 12-hp models. New crawler-mounted series are especially suited where traction or flotation is marginal, or where a considerable amount of maneuverability is required. Crawler trenchers are completely self-propelled, and equipped with a steering device that takes "muscle" out of maneuverability. Unit is adaptable for digging in frost conditions and rocky soil conditions because of additional weight. Also excellent for digging foundation footings.

CIRCLE (37) ON THE REPLY CARD

* * *

The major menaces on the highways today are drunken driving, thumbers for rides and one-armed driving. To put it briefly, Hick, Hike, and Hug.

One-Man crane . . . Unusual design of Focowil's all hydraulic jib-boom type crane enables driver alone to load and unload almost anything, in bulk or in units of up to 3.3 tons. Gears, running cables, pullies, winch and similar wear components have been eliminated with a boom that elevates, depresses, turns, telescopes and "elbows." Crane pillar is side mounted for maximum reach and strength with minimum weight; boom folds and telescopes into a 15-in. space athwart truck channels for travel. Maximum lifting height is 24 ft; at maximum reach, lifting capacity is 2200 lb, on short boom, up to 6600 lb.

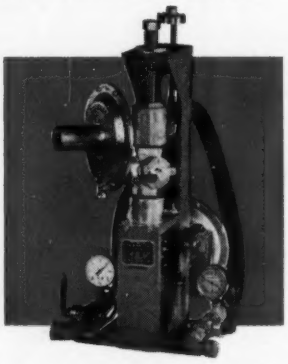
CIRCLE (38) ON THE REPLY CARD

UNIVERSAL

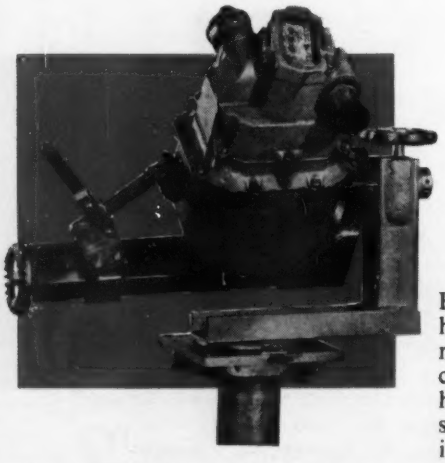
Time and Labor saving equipment for regulator and meter maintenance

REGULATOR REPAIR AND TEST STANDS

This dual-purpose shop fixture serves as a vise to securely hold regulators of any make in a fixed, convenient position for repairing and testing. New regulators are tested, made ready and set for service in less than one-fourth the time usually required. Hundreds in use throughout the United States and Canada. Saves countless hours and labor . . . assures better repairs and precision settings.



Type 480 Universal Regulator Repair and Test Stand. Complete information in bulletin No. 570.



Type 500 Universal Meter Repair Rack. Ask for completely illustrated bulletin No. 570.

METER REPAIR RACKS

Bench or pedestal mounted rack for holding hard-case meters in a "cradle", rigidly locked between rubber-faced clamping blocks. "Cradle" rotates both horizontally and vertically, and may be securely locked in any fixed position for inspection or repair. Repairman's hands are free for easy manipulation of tools or instruments. Used for over ten years in shops in all sections of U.S. and Canada.

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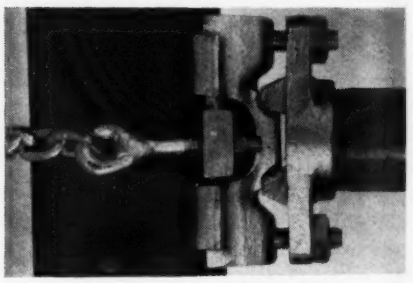
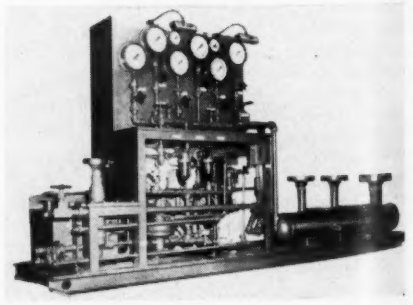


Pipe saddle . . . New type pipe saddle, utilizing "chain-tong" principle fits all pipe sizes from 1½ to 16-in., as well as permitting perfect fit over pipe coating and insulation. Chain wraps around pipe and is quickly and easily tightened with single bolt at one side of the saddle. Helps eliminate problem of storage and supply with one "universal" leveling saddle for all size pipe.

CIRCLE (39) ON THE REPLY CARD



Low cost test stand . . . New test stand, manufactured to ASME requirements by Farris Engineering Corp. and available at ⅓ cost of built-in-plant test stands, will test all valves including globe, gate, plug cocks, safety and relief plus other hydraulic-pneumatic equipment up to pressures of 2000 psi. All controls are within reach on one panel. Unit is compact—10½ by 3 ft wide.

CIRCLE (40) ON THE REPLY CARD